Humboldt-Universität zu Berlin

DISSERTATION

Socio-Demographic and Psychological Determinants of Water Conservation Behavior: Evidence from Germany and Jordan

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Dedicated to

my parents

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Abstract

Water is one of the most important resources and all life depends on it. For instance, humanity relies on sufficient water supply to satisfy agriculture, industry, and household demands. However, the global water deficit was estimated to reach about 40% by 2030. Climate change, changing lifestyles, and population growth increase the supply and demand gap further. As a consequence, more and more regions experience water scarcity. In that context, reduced household water demand due to enhanced water conservation could alleviate the problem or, at least, reduce the pressure on water resources. Thus, this thesis aims to contribute to a better understanding of the socio-demographic and psychological determinants of water conservation behavior.

Based on three distinct datasets from Germany and Jordan, the manifold facets of water conservation and its determinants were examined. From a conceptual perspective, the relationship between water conservation and environmental attitude, a latent construct representing cooperative, prosocial, and even moral tendencies, were investigated. Furthermore, water conservation in Germany was used as a proxy for moral behavior. In that respect, environmental attitude and the personality factor Honesty-Humility were compared in order to determine, which factor constitutes the better predictor of moral behavior. Using original data from Jordan, a comprehensive impact evaluation of a water conservation awareness campaign revealed detailed information on its actual effects. The data showed that only one out of three awareness dimensions changed due to the campaign, yet conservation behavior was positively influenced. Another analysis focused on a wide variety of water conservation determinants in Jordan. The results indicate that water conservation does not differ with respect to age, education, and income, but rather with different levels of environmental attitude.

This thesis provides valuable information for researchers and policy makers alike. The detailed examination of various water conservation determinants offer a great potential for an improved management of household water demand. In particular, it showed that psychological factors play a much greater role in behavior change than socio-demographic variables.

Zusammenfassung

Wasser ist eine der wichtigsten Ressourcen und alles Leben hängt von ihr ab. Zum Beispiel ist die Menschheit auf ein ausreichendes Wasserangebot angewiesen, um die landwirtschaftliche, industrielle und Haushaltsnachfrage zu stillen. Jedoch schätzt man, dass sich das globale Wasserdefizit schon im Jahr 2030 auf ca. 40 Prozent belaufen wird. Klimawandel, veränderte Lebensweisen, und Bevölkerungswachstum verstärken das Nachfrage-Angebot-Defizit. Als Konsequenz leiden immer mehr Regionen unter Wasserknappheit. Eine reduzierte Wassernachfrage bedingt durch verstärktes Wassersparen kann das Problem verringern. Das Ziel dieser Dissertation ist es daher, zu einem besseren Verständnis der sozio-demographischen und psychologischen Determinanten von Wassersparverhalten beizutragen.

Basierend auf drei Datensätzen aus Deutschland und Jordanien wurden die verschiedenen Facetten von Wassersparverhalten und deren Determinanten beleuchtet. Das Verhältnis zwischen Wassersparen und Umwelteinstellung, einem latenten Konstrukt, das kooperative, prosoziale und sogar moralische Tendenzen widerspiegelt, wurde konzeptionell untersucht. Zusätzlich wurde Wassersparen in Deutschland als ein Repräsentant für moralisches Verhalten verwendet. In diesem Zusammenhang wurden Umwelteinstellung und der Persönlichkeitsfaktor Ehrlichkeit-Bescheidenheit auf ihr Vermögen hin verglichen, moralisches Verhalten vorherzusehen. Eine ausführliche Analyse zur Bewertung einer Kampagne zur Förderung des Wassersparbewusstseins hat detaillierte Informationen zu ihren tatsächlichen Effekten gezeigt. Trotz einer Veränderung des tatsächlichen Verhaltens wurde nur eine von drei Bewusstseinsdimensionen durch die Kampagne beeinflusst. Eine weitere Analyse hat sich auf die Determinanten von Wassersparverhalten in Jordanien konzentriert. Die Ergebnisse zeigen, dass Wassersparverhalten nicht durch Alter, Bildungsgrad und Einkommen beeinflusst wird, sondern eher durch die Ausprägung der Umwelteinstellung.

Diese Dissertation liefert wertvolle Informationen für Forscher und Politiker. Die detaillierte Untersuchung von verschiedenen Wasserspardeterminanten birgt großes Potenzial für ein verbessertes Wassermanagement. Insbesondere konnte gezeigt werden, dass psychologische Faktoren eine weit größere Rolle als sozio-demografische Variablen spielen.

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List of Abbreviations

BBU	Bundesverband Bürgerinitiativen Umweltschutz
BUND	Bund für Umwelt und Naturschutz Deutschland
DESTATIS	Federal Statistical Office Germany
EUR	Euro
FAO	Food and Agriculture Organization of the United Nations
GEB	General Ecological Behavior scale
HH	Honesty-Humility personality factor
JD	Jordanian Dinar
MCM	Million Cubic Meter
MENA	Middle East and North Africa
MRCML	Multidimensional Random Coefficient Multinomial Logit model
MWI	Ministry of Water and Irrigation Jordan
NHIP	New Human Interdependence Paradigm
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary-least squares regression
PAP	Public Action for Water, Energy and Environment Project
UBA	Umweltbundesamt
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Program
UNEP	United Nations Environmental Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNHCR	Office of the United Nations High Commissioner for Refugees
USAID	United States Agency for International Development
USCB	United States Census Bureau
WEPIA	Water Efficiency and Public Information for Action Program

1 General Introduction

1.1 Background and context

Water is one of the most important resources on earth. In fact, every living species is dependent on water in on or the other way. In abstract terms, it depends on water at a certain quality and in sufficient amounts. Humans use potable water for domestic consumption, but also rely on it for the production of goods and services. However, ever rising water needs have led to a dramatic imbalance between overall availability and demand. The global water deficit was projected to reach 40% by 2030, if no adjustments to the governance of water resources were achieved (2030 WRG, 2009). However, as the international community agrees, water availability is indeed sufficient to satisfy the world's growing needs (UNESCO, 2015). Yet, tremendous efforts need to be undertaken to create a water secure world.

This objective is challenged by several factors. For instance, the world's population grows on average by about 80 million people per year (USCB, 2012). By 2050, it was estimated to reach 9.1 billion (UNDESA, 2013). Urbanization, changing consumption patterns, and rising living standards of a growing middle class put additional pressure on water resources. Statistics showed that over the last decades, water demand increased twice the rate than the global population (Shiklomanov, 1999; USCB, 2012). As a consequence, global demand is projected to increase by 55% between 2000 and 2050, while domestic demand is likely to double (OECD, 2012).

Even though agriculture and industry are the predominant water users, domestic demand bears a great potential to address the water imbalance. While urban water demand management entails a wide variety of measures to curtail demand, research has found great differences in effectiveness. For instance, the most common tool water managers employ are water tariffs. But several meta-studies reported that water is rather price inelastic (e.g. Arbués, Villanúa, & Barberán, 2010; Dalhuisen, Florax, De Groot, & Nijkamp, 2003; Espey, Espey, & Shaw, 1997). In addition, many water suppliers are public and, thus, face profit constraints, which limits their flexibility in adjusting tariffs. An undesirable side-effect of successful demand reductions by means of changing tariffs is that overall funds to maintain the water infrastructure are reduced. Moreover, price

signals are always prone to rebound effects. After a short decline, consumers tend to increase consumption after some time, when they got used to the new tariff level.

In contrast, long-term demand reductions can be achieved by voluntary commitment to protect the water resource. If individual behavior is guided by an intrinsic motivation to consume less water, enhanced water conservation behavior can become resilient against external forces. However, people are assumed to differ on a strictly behavioral level, which does not pose direct implications on actual demand. This notion reflects differences in living standards and other conditions, which have a general impact on water demand independent of a person's personality, values, or attitudes with respect to water conservation.

Thus, this dissertation aimed to better understand, why some people engage more in water conservation than others with a particular focus on socio-demographic and psychological determinants. Data for Germany, a water abundant country, and Jordan, a water scarce country, was used. Despite the differences in socio-cultural context, similar data and analysis methods were employed for both countries. The next section describes each context in more detail.

1.2 Water in Jordan

Jordan is one of the most water scarce countries in the world. In terms of available renewable resource per capita, Jordan was ranked the 7th lowest on earth by UNDP (2013). For decades, it has suffered from extreme water shortages, which have been exacerbated by drought, depletion of groundwater reserves, climate change, inflow of migrant workers and refugees, and steady population growth. For instance, the indigenous population growth rate was estimated to be 2.8 percent, which would lead to a total population of 10 million by 2020 (Potter, Darmame, Barham, & Nortcliff, 2007). At the end of 2014, Jordan counted 6.6 million inhabitants (Worldbank, 2015) and additionally 1.4 million Syrian refugees (Jordan Times, 2014), of which only half were officially registered (UNHCR, 2015). Until 2010, demand reached a total of 1097 MCM and was projected to increase by 50% until 2030 (MWI, 2012b).

Water resources are mainly composed of surface water and groundwater, whereas treated wastewater only makes up for a negligible share (Table 1.1). Surface water is mostly derived from the Yarmouk River (150 MCM), which borders Syria and Israel (Nortcliff, Carr, Potter, & Darmame, 2008). Groundwater, as the major water source, is already exploited above a sustainable extraction rate of approximately 50% on average (Nortcliff et al., 2008). 10 out of 12 aquifers are overstressed (El-Naser, 2012).

Table 1.1: Annual water consumption by source and use per sector in MCM

Source	**Municipal**	**Industry**	**Agriculture**	**Total**	
Surface water	53.4	2.5	215.7	271.6	*33%*
Groundwater	185.8	34.2	253.7	473.7	*58%*
Treated wastewater	0	0	72	72	*9%*
Total	239.2	36.7	541.4	817.3	
	29%	*4%*	*66%*		

Source: MWI, 1997

The only source of water to recharge aquifers is rainfall, which is scarce and varies dramatically across the country. Even though total rainfall is estimated at 8,360 million cubic metres per year, immediate evaporation takes 90% as its toll (Nortcliff et al., 2008). In total, water supply is limited to approximately 900 MCM over the next decades (El-Naser, 2012). This leads to a deficit between demand and supply of more than 500 MCM until 2030.

In order to address this gap, the national water strategy called "Water for Life" (MWI, 2009) was initiated. One central aspect is the reduction of urban water demand and it emphasizes the need of water conservation. The Ministry of Water and Irrigation (MWI) has already developed a "Residential Water Use Efficiency Guide" (MWI, 2012a), which demonstrates the current state of knowledge. However, how these best management practices are communicated to the public is a challenge for the future. Between 2000 and 2005, a countrywide water conservation campaign was implemented to increase people's awareness and conservation commitment (USAID, 2005). A cartoon figure called Abu Tawfeer appeared on various media channels to promote water

conservation. Chapter 4 presents a detailed impact analysis on the actual effects of this campaign.

What makes Jordan special is the persistent shortage of water, which calls for long-term solutions. Unlike in cases of temporary droughts, Jordan requires systematic efforts, which have a lasting impact on people's water use. In this context, this dissertation provides a valuable contribution by investigating socio-demographic and psychological characteristics to better understand water conservation behavior in Jordan. This is particularly relevant, as initiatives, which target people's attitude towards water and environmental protection may not only lead to a sustained conservation effect, but also come at lower cost than infrastructure investments.

1.3 Water in Germany

Germany is a water rich country with an amount of 188 billion m^3 available per year. In terms of per capita water availability, this relates to 6,279 liters per day (UBA, 2010). Compared to Jordan, where 157 liter per day is available per person (MWI, 2012b), Germany has sufficient water resources to meet all water demands. Interestingly, over the last decades domestic water consumption steadily declined from 144 liter per day in 1991 to 121 liter per day in 2010 (DESTATIS, 2013). During that time average monthly incomes increased from 1,832 EUR to 3,227 EUR (DESTATIS, 2015). Thus, one would rather assume that water consumption increased due to higher living standards. But there are certain aspects, which make Germany appear as a special case.

Starting in the 1970s, several organizations were formed, which dramatically influenced the public opinion on environmental issues. Among others, the BBU represented the radical branch of environmentalists, the BUND, founded in 1975, has become the largest environmental organization in Germany, and Die Grünen (The Greens) entered the political sphere in 1979 (Dryzek, Hunold, Schlosberg, Downes, & Hernes, 2002). The success of this party is representative for the dispersion and establishment of environmental thoughts on a national level. In line with the development of these organizations, people's attitudes towards the environment and environmental protection changed as

well. This dissertation aimed to investigate the relationship between water conservation and environmental attitude as it is today.

1.4 Data

In total, three different datasets were used. Two datasets were collected by myself, whereas one was provided by USAID through Mirja Michalscheck. I personally received permission to use the data for research purposes. For both of my datasets a paper-based questionnaire was used, which I developed based on the relevant literature from the fields of environmental psychology and water demand management. A survey was conducted in Germany in fall 2012 and in Jordan in spring 2013. In Germany, the target group was undergraduate students at Humboldt-University of Berlin (N=760), who were enrolled in five different faculties: law (n=343, 45.1%), business (n=71, 22.5%), agricultural sciences (n=155, 20.4%), mathematics (n=53, 7.0%), and American studies (n=38, 5.0%). Similarly, participants in Jordan were undergraduate students from four different faculties (N=725): agriculture (n=230, 31.7%), medicine (n=214, 29.5%), business (n=157, 21.7%), and foreign language (n=124, 17.1%).

The USAID dataset (N=367) is based on a countrywide survey in Jordan from 2010, which was part of the Public Action for Water, Energy and Environment Project (PAP). It is composed of various socio-demographic characteristics, people's housing situation, their opinions, assessments, and perceptions regarding water, energy, and household waste. In contrast to the student samples, the USAID dataset shows an age range from 18 to 80 years, five education profiles from "no formal education" up to "university degree or higher", and a distinction of three income categories (for detailed information see Chapters 4 and 5). All three datasets constitute a comprehensive compilation of water conservation and socio-demographic and psychological determinants.

1.5 Statistical approaches

The diverse nature of the three datasets and the complex research objective required a set of statistical approaches from the fields of economics and social

psychology. First, correlation analysis was used to assess the linear overlap between variables. When the variables were continuous and (quasi) normally distributed, Pearson coefficients were applied, whereas for categorical variables, Kendall tau b coefficients were used (e.g. Chapter 4). Second, when the objective was to assess the direction and relative size of water conservation determinants, ordinary-least squares (OLS) regression was employed. This technique stands out due to its simplicity and straight-forward interpretability. Third, Chapter 4 furthermore contains an instrumental variable model, when we tested for endogeneity between water conservation behavior and three awareness factors. As the direction of the relationship between the variables was ambiguous, this model helped to disentangle the effects. Fourth, cluster analysis (e.g. Bacher, Pöge, & Wenzig, 2010; Backhaus, Erichson, Plinke, & Weiber, 2006) based on socio-demographic characteristics was applied in Chapter 5 to analyze, whether water conservation behavior differs between coherent societal groups. Note that there is no detailed description of these statistical methods. It is valid to assume that they are generally known by the common reader. For further details, see standard textbooks (e.g. Davidson & MacKinnon, 2004).

When assessing people's attitude, a Rasch model (Bond & Fox, 2007) was applied. This model was originally used to measure human competencies by means of behavioral observations (Wright & Masters, 1982). For instance, the model revealed that a student, who was able to correctly answer difficult algebra and geometry questions, has a higher mathematics competency than a student, who scores lower on similar questions. Recently, environmental psychologists have applied this model to measure the concept of environmental attitude, e.g. in California (Kaiser & Wilson, 2000), Sweden (Kaiser & Biel, 2000), and Switzerland (Kaiser, 1998; Kaiser & Keller, 2001). In this context, the performance of individual behaviors, which are directed towards environmental protection, give rise about a person's level of environmental attitude (Kaiser, Byrka, & Hartig, 2010). A detailed description of the Rasch model and the underlying conceptualization of attitude and behavior can be found in the respective chapters.

1.6 Research objective and thesis overview

The overarching research objective was to better understand the socio-demographic and psychological factors, which influence water conservation behavior. Each study focused on different aspects, which in sum provide a comprehensive overview. Both conceptual questions and practical matters were addressed. In the following, each study (Chapter 2-5) is presented and briefly summarized.

Chapter 2 deals with the attitudinal disposition behind water conservation. While water conservation is similar to other ecological behaviors, the question remained, if both groups of behaviors share the same latent motivation. As previous research identified environmental attitude as the underlying disposition behind ecological behavior, we empirically tested the conceptual overlap between water conservation attitude, the disposition behind water conservation behavior, and environmental attitude. The comparison of a one-dimensional model with a two-dimensional model showed almost equal model fit statistics. Thus, a clear conclusion was not possible.

In Chapter 3, two latent constructs are compared in terms of their potential to predict moral behavior, which was represented by water conservation in Germany. Environmentalism, a person's tendency to act ecologically, and Honesty-Humility, a personality factor representing cooperative, prosocial, and moral tendencies, were assessed as predictors. In sum, both factors significantly explained differences in moral behavior, yet environmentalism had a substantially greater overlap with moral behavior.

Chapter 4 describes the long-run impact of a water conservation awareness campaign in Jordan. Using data from 5 years after the end of the campaign, a robust statistical approach was used to disentangle the effect of the campaign on three awareness factors as well as on actual conservation behavior. The data revealed that the campaign only affected people's awareness of human responsibility for the water situation and solutions. In turn, this factor and knowledge of water conservation actions influenced conservation behavior.

Chapter 5 provides a comprehensive account of determinants of water conservation in Jordan. Using two different datasets, it shows the direction and size of the effect of various socio-demographic and psychological characteristics

on individual conservation behavior. For instance, variables such as age, education, and income were found irrelevant for explaining differences in conservation behavior. However, people's attitude towards environmental protection, namely environmental attitude, explained a large share of variation in the data. A subsequent test suggested that it can be considered the underlying stable disposition behind water conservation.

1.7 Statement of contribution

This dissertation is composed of four articles, which provide a manifold overview of the determinants of water conservation behavior in Germany and Jordan. Even though this work was not part of any research project, I relied on the help of some people. Nonetheless, I was the lead author in all cases. In the following, I will describe my contribution for each paper.

1st Paper (Chapter 2) & 2nd Paper (Chapter 3)

Siegmar Otto and I developed the final outline and research focus of the papers. With his help, I designed the questionnaire. I organized and conducted the survey to collect the data at Humboldt-University of Berlin in fall 2012. Alexandra Kibbe provided valuable support with the Rasch calibrations. Siegmar Otto helped to draft the introduction of the 2nd paper. Amid that, the papers were completely written by myself, while my coauthors reviewed them and gave helpful feedback.

3rd Paper (Chapter 4)

Based on the USAID dataset provided by Mirja Michalscheck, I developed the concept, research objective, and methodology of the paper and completed it. Meike Weltin helped with the statistical analysis. Both coauthors acted as valuable reviewers of the final draft manuscript.

4th Paper (Chapter 5)

Using the same USAID dataset and a dataset based on an own survey at the University of Jordan in 2013, I designed and wrote this paper. Mirja Michalscheck gave helpful comments during this process.

2 Exploring the Attitudinal Dimension behind Water Conservation

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Abstract

Water conservation is often treated as a separate topic in practice and research. Yet, both water conservation and pro-environmental behavior share traits such as modesty, cooperativeness, and altruistic tendencies. Hence, based on cross-sectional survey data (N=760) this article examines, whether water conservation and pro-environmental behavior draw from the same latent disposition, namely environmental attitude. A two-dimensional model conceptualizing water conservation and environmental protection as distinct attitudes is compared to an alternative one-dimensional model. The two-dimensional model is found to be marginally superior, yet, both concepts almost perfectly overlap and predictive gains of a separate conceptualization are negligible. Thus, changing people's environmental attitude is likely to cause behavioral change in many related environmental sub-domains including water conservation. Our research offers substantial benefits for environmental and water managers. By integrating water conservation into general environmental efforts, individual conservation objectives can be realized more efficiently.

2.1 Introduction

Environmental pollution, the over-exploitation of natural resources, and the destruction of entire ecosystems often stem from self-interested individual behavior at the expense of the public good, described as "The Tragedy of the Commons" (Hardin, 1968). Water, as an essential element of life, has become one of the most threatened resources (e.g. FAO, 2013; UNEP, 2014). Water managers are increasingly concerned about how to manage domestic demand in response to declining resources, increasing consumption patterns, and population dynamics. Possible conservation instruments include approaches for promoting behavioral change such as information campaigns or educational programs (e.g. Cockerill, 2010) that are aimed at changing people's attitude toward water as a resource, or more specifically, water conservation.

Eagly and Chaiken (1993) described an attitude as a person's internal state with respect to a favorable or unfavorable evaluation of a certain object (e.g. water conservation). Attitudes can be expressed overtly in emotional, verbal, or behavioral responses. For example, a person with a strong water conservation attitude is likely to perform respective conservation behaviors such as buying water-efficient household devices or checking boxes on a questionnaire to highlight the importance of saving water (DeFleur & Westie, 1963). Given the broad variety of response options, people make individual choices about how to express their commitment to an overall conservation goal. In turn, any such diverse responses reflect a person's particular attitude level. An understanding of the attitudinal dimension behind water conservation is, hence, an essential prerequisite for promoting behavioral change.

Examining the nature and scope of past water conservation campaigns, one aspect is interesting to observe. The objective to change people's water conservation behavior was all too often realized by isolated approaches, which do not take other environmental topics into consideration (e.g. Baumann, Boland, & Haneman 1998; Howarth & Butler, 2004; Ouda, Shawesh, Al-Olabi, Younes, & Al-Waked, 2013; UK Environment Agency, 1999). Especially in times of limited public funding for environmental protection, campaigns focusing only on one environmental issue at a time, thus, seem somewhat inefficient. This claim is based on the widely accepted notion that water conservation can be considered an integral part of the environmental domain.

In line with this thought, empirical research has compiled indicative evidence for a close relationship between water conservation behavior and various latent ecologically relevant constructs. For instance, scholars have empirically linked water conservation behavior or water use to concepts such as environmental beliefs (Corral-Verdugo, Bechtel, & Fraijo-Sing, 2003), environmental consciousness (Mondéjar-Jiménez, Cordente-Rodríguez, Meseguer-Santamaría, & Gázquez-Abad, 2011), and environmental concern (Wolters 2014). Clark and Finley (2007) predicted water conservation intentions with general environmental beliefs. Furthermore, Dolcinar, Hurlimann, and Grün (2012) found that Australian residents who engaged in pro-environmental behaviors were also more likely to take actions toward water conservation. Such findings suggest that water conservation behavior is related not only to other pro-environmental behaviors, but also to people's general evaluations of the environment. In addition, water conservation and ecological behaviors have two central aspects in common: First, they result in some form of environmental protection or avoidance of environmental harm, and second, they imply unselfish and pro-social orientations as opposed to self-interested attitudes, values, and beliefs (Cialdini, 2003; Corral-Verdugo & Frías-Armenta, 2006; Kaiser & Byrka, 2011; Kaiser & Scheuthle, 2003; Stern 2000). Acknowledging this rich body of literature, the question remains why water conservation is often treated as an isolated class of behavior.

While the above-mentioned studies strongly suggest that water conservation and pro-environmental behavior are closely related because they can be explained by similar variables, we go one step further by proposing that both types of behavior are driven by virtually one and the same underlying disposition, namely, environmental attitude (e.g. Kaiser, Wölfing, & Fuhrer, 1999). In other words, we would expect environmental attitude to overlap completely with water conservation attitude. Despite other scholars' indicative findings (e.g. Corral-Verdugo et al., 2003; Mondéjar-Jiménez et al., 2011), empirical studies have yet to systematically test this claim. Thus, utilizing a cross-sectional data set, the present study applied a Rasch model to, first, measure water conservation and environmental attitude and, second, explore the dimensionality of their overlap. A distinct superiority of the multidimensional solution, e.g. substantially better model fit and prediction of actual outcomes,

is required to conclude that water conservation attitude is not an integral part of environmental attitude. Else, the results would imply that water conservation initiatives could well be integrated into holistic environmental protection programs, thus making conservation efforts more efficient in terms of resource spending. In the following, we will review the literature on studies that have explored the relations between psychological factors and water conservation.

2.1.1 Determinants of water conservation behavior

Scholars have extensively studied the relationship between latent psychological factors such as motives, concerns, or beliefs and the tendency to engage in water conservation. Stronger motives with regard to water consumption have been found to result in greater conservation efforts (Corral-Verdugo, 2002). Attitudes toward water usage, pricing, household savings (Randolph & Troy, 2008), and social norms regarding water conservation (Lam, 1999; Trumbo & O'Keefe, 2005) were found to be positively related to water conservation behavior. Investigating the role of people's beliefs, Corral-Verdugo et al. (2003) reported that ecological beliefs (e.g. "Drinkable water will exhaust very soon, if we do not save it") support water conservation, whereas utilitarian beliefs (e.g. "Drinkable water is an unlimited resource") tend to inhibit efforts to save water. Even though it may seem trivial that a positive inclination toward an object results in corresponding behavioral responses, other studies have not been able to establish significant relations between water conservation attitudes and behavior (e.g. Aitken, McMahon, Wearing, & Finlayson, 1994; De Oliver, 1999; Gregory & Di Leo, 2003; Miller & Buys, 2008). In an attempt to explain such ambiguous findings, Russel and Fielding (2010) emphasized the importance of a match in the specificity of the attitude and behavior variables. That is, if the behavior instrument consists of the same class of actions that are used for the attitude measure, it is not surprising to find a close link between the two variables.

Interestingly, beyond such specificity requirements, researchers have also empirically linked water conservation to other more universal concepts. For instance, Corral-Verdugo, Carrus, Bonnes, Moser, and Sinha (2008) reported that 13% of the variance in water conservation behavior was explained by environmental worldviews measured by the New Human Interdependence

Paradigm (NHIP). Describing the impact of environmental consciousness or awareness on water conservation behavior, a similar amount of explained variance (13.2%) was found by Mondéjar-Jiménez et al. (2011). Despite identifying a rank-order correlation of ρ=.95, Willis, Stewart, Panuwatwanich, Williams, and Hollingsworth (2011) found discriminant validity between the two attitudinal factors *environmental concern* and *water conservation awareness and practice* in explaining differences in the end use of water. In sum, these results imply that the conceptual link between water conservation actions and pro-environmental behavior, and thus their underlying dispositions, is rather small or does not exist at all.

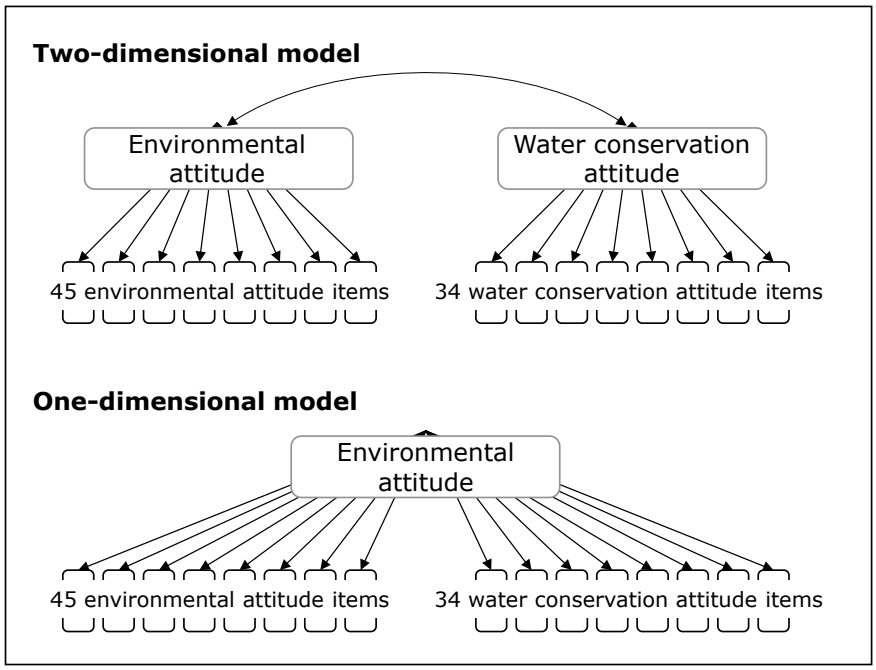

Figure 2.1: Schematic representation of the two models

One could theoretically argue that, in contrast to the findings presented above, water conservation belongs to the environmental domain, as any such behavior results in some form of environmental protection. Hence, environmental attitude could be understood as a universal and comprehensive concept that overlaps completely with more specific attitudes such as water conservation attitude. Figure 2.1 outlines the two different theoretical models presented here. The two-dimensional model represents the notion that environmental attitude and water conservation attitude are two separate constructs that do not fully

converge. The one-dimensional model assumes that water conservation attitude is captured by environmental attitude, and hence, all of the items can be calibrated on a single scale. A more detailed description of the attitude-behavior relationship is presented in the following. As the literature presents various conceptualizations of environmental attitude, we will elaborate on this concept in more detail and clarify how we used it here.

2.1.2 Definition of environmental attitude

Environmental attitudes have been subject to controversial discussion among conservation psychologists with respect to the dimensional structure of the concept (i.e. one-dimensional vs. multidimensional). Despite encompassing several seemingly distinct classes of behaviors, actions as diverse as consumerism, energy saving, recycling, and sustainable transportation have been found to be based on a single underlying factor (e.g. Kaiser & Wilson, 2004). For example, a person who donates to a rainforest protection organization, takes showers instead of baths, and installs solar panels on his or her roof is likely to have a strong pro-environmental attitude, as all of these behaviors are aimed at environmental protection. In that sense, engagement in any environmentally responsible behavior can be taken as a reflection of a person's degree of environmental attitude.

Conversely, other studies have suggested that environmental attitudes reflect a rather multidimensional structure by which two underlying motives, or higher order factors, are distinguished and are framed as *preservation* and *utilization* (Bogner & Wiseman, 1999, 2002; Milfont & Duckitt, 2004; Thompson & Barton, 1994). *Preservation* is directed toward environmental protection and includes the protection of all species and natural environments in their original states. *Utilization*, by contrast, reflects gains in personal utility that are derived from experiencing nature, i.e. nature with all its elements as an object to be utilized in order to increase human satisfaction (Milfont & Duckitt, 2010). In line with this distinction, environmental protection has been found to be positively linked to unselfishness (Kaiser & Byrka, 2011) and moral/altruistic values (Kaiser & Scheuthle, 2003), yet ecological behavior seems to be negatively related to self-interest and utilization-oriented environmental attitudes (e.g. Milfont & Duckitt, 2004; Schultz, Gouveia, Cameron, Tankha, Schmuck, & Franek, 2005), or even

not related to these constructs at all (Kaiser, Hartig, Brügger, & Duvier, 2013). Conceptualizing ecological behaviors as acts that are directed toward achieving environmental protection, we view environmental attitude as simply the latent disposition that underlies behavioral responses to the concept of *preservation* and not *utilization*.

Moreover, it is important to understand how environmental attitude is conceptually related to pro-environmental behavior. Therefore, we applied the so-called Campbell paradigm, which is grounded in the claim that attitude and behavior form an axiomatic instead of a causal relation (Kaiser et al., 2010). When targeting a goal, people usually choose from various alternatives to express their individual level of aspiration. Differences in esteem for an attitudinal object become obvious in the extent to which a person engages in increasingly demanding behaviors (Campbell 1963). We can expect a person who is strongly devoted to environmental protection to engage in various ecological behaviors and be willing to undertake great sacrifices to realize his or her goal. For instance, instead of buying beverages in cans, people may prefer returnable bottles. Or, likewise, people may use a bike or public transportation instead of driving a car. By contrast, a person's devotion to environmental protection must be rather low if the smallest inconvenience is sufficient to prevent that person from engaging in any ecologically relevant activities.

Performing a behavior involves costs and sacrifices that include monetary expenses, time, and personal effort (Kaiser & Wilson, 2004). Behavior-specific "difficulties" are generally the same for all persons in the same situational (i.e. socio-cultural, geographic, or political) context. For example, checking boxes on a survey to express environmental concern is generally easier than installing solar panels for all people. Measuring the engagement frequency of behaviors reveals the contextual difficulty of each behavior. Given the differences in the amount of effort required, it is reasonable to believe that people choose their activities prudently, i.e. they prefer a convenient behavior over a more demanding one (Kaiser et al., 2010). It follows that a rational person who engages in a particular behavior is also likely to engage in any other behaviors that are directed at toward the same objective but are less demanding.

Being aware of the controversy related to the Campbell paradigm in social psychology research, note that we do not claim that attitudes and behaviors are

the same. Instead, conceptualizing their relationship in an axiomatic way merely allows for an alternative attitudinal measurement approach. In an attempt to overcome standard problems with self-reported evaluations, grounding attitude measurement in behaviors reduces the likelihood of response biases, as the threshold is higher to lie on actions compared to how much one agrees with an object or how important it is. As outlined above, information on a person's level of environmental attitude can be derived based on his or her performance of a class of behaviors contextually related to that attitude object. And, vice versa, a particular attitude level makes the performance of respective behaviors within its own class more or less likely. Thus, attitudes and behaviors are closely related, but not identical concepts.

2.1.3 Research objective

This paper follows up on previous work that investigated the role of environmental attitude in predicting ecological behaviors in general and water conservation behaviors in particular. Theoretically, those two behavioral classes resemble each other with respect to prosocial, cooperative, and ecological dispositions. Bearing such motivational similarities in mind, why would a person who engages in various forms of environmental protection not strive to minimize his or her degree of water consumption as well? Previous studies (e.g. Mondéjar-Jiménez et al., 2011; Willis et al., 2011) provided empirical evidence that water conservation and ecological behavior are closely related and can be explained by similar variables. Furthermore, recognizing that environmental attitude accounts for at least 50% of the variance in ecological behavior (e.g. Kaiser, Wölfing, & Fuhrer, 1999), we aimed to test whether a similar group of behaviors, namely water conservation, would be based on the same latent disposition. Technically, we examined whether a two-dimensional model for conceptualizing water conservation and environmental protection as separate dimensions would be more appropriate than an alternative one-dimensional model. We then compared the two models with respect to item functioning, average residuals, and instrument validity.

2.2 Method

2.2.1 Participants and procedures

The sample was composed of undergraduate students at Humboldt-University of Berlin, Germany. One class was randomly selected for questionnaire distribution from each of five university departments. With the approval of the lecturer, we distributed the questionnaire in the classroom and collected it upon completion. As participation was voluntary and did not bear any incentives such as course credit or a lottery for prizes, some students decided to leave the room. In order to circumvent any social desirability bias, the questionnaire was anonymous, and the lecturers did not participate in the procedure. Most of the participants needed between 15 and 30 minutes to complete the questionnaire.

A total of 760 students submitted a completed questionnaire. The students were majoring in law (*n*=343, 45.1%), business (*n*=171, 22.5%), agricultural sciences (*n*=155, 20.4%), mathematics (*n*=53, 7.0%), and American studies (*n*=38, 5.0%). 435 participants (57.2%) were female, and all respondents were enrolled in an undergraduate program. Thus, even though we did not ask for age, the majority of the respondents were between 18 and 22 years of age. Our study did not require a data set that was fully representative of the entire population of Germany. It was rather critical for the items measuring the two key variables, water conservation attitude and environmental attitude, to show a sufficient degree of discrimination between respondents and items.

2.2.2 Measures

Environmental attitude was measured with a modified 45-item version of the well-established General Ecological Behavior (GEB) scale (see Table 2.1), which originally consisted of 50 items (Kaiser & Wilson, 2004). The application of Rasch model-based measures made it possible to vary our choice of items because scale calibration requires only that all items fall into a single class of behaviors, here, ecological engagement (Bond & Fox, 2007). The GEB scale is composed of six sub-domains: energy conservation, recycling, consumerism, mobility and transportation, waste avoidance, and social behaviors related to environmental protection. 15 items were framed with a yes/no response format, whereas the other 30 items offered a 5-point frequency scale ranging from 1="never" to

Table 2.1: 45 environmental attitude items

	Environmental Attitude	δ_{one}	MS_{one}	δ_{two}	MS_{two}
1	I contribute financially to environmental organizations.	2.80	1.13	2.75	1.06
2	I am a member of an environmental organization.	2.56	1.09	2.51	0.99
3	I buy domestically grown wooden furniture.	2.44	1.18	2.39	1.01
4	I drive on freeways at speeds under 100km/h (= 62.5 mph).	2.20	1.39	2.14	1.06
5	I am a member of a carpool.	2.04	1.13	1.99	1.06
6	I buy milk in returnable bottles.	1.88	1.13	1.82	1.06
7	I own a fuel-efficient automobile (less than 3.5 liter per 100 km).	1.83	1.14	1.77	1.04
8	At red traffic lights, I keep the engine running.*	1.78	1.11	1.72	1.03
9	I boycott companies with an unecological background.	1.70	0.94	1.65	0.94
10	I point out unecological behavior to others.	1.57	0.91	1.51	0.94
11	I buy products in refillable packages.	1.38	1.03	1.32	0.99
12	I buy meat and produce with eco-labels.	1.07	0.97	1.01	0.98
13	I talk with friends about problems related to the environment.	1.04	0.89	0.98	0.93
14	I buy convenience foods.*	0.98	1.07	0.92	1.00
15	I read about environmental issues.	0.91	0.94	0.84	0.94
16	If I am offered a plastic bag in a store, I take it.*	0.79	1.04	0.72	1.02
17	For longer journeys (more than 6 hours), I take an airplane.	0.56	1.13	0.49	1.06
18	I have looked into the pros and cons of having a private source of solar power.	0.32	0.99	0.26	1.01
19	I refrain from owning a car.	0.05	1.02	-0.01	1.02
20	In the winter, I leave the windows open for long periods of time to let in fresh air.*	0.03	1.00	-0.04	1.04
21	I collect and recycle used paper.	0.02	0.96	-0.04	0.95
22	I keep the engine running while waiting in front of a railroad crossing or in a traffic jam.*	0.00	1.04	-0.07	1.02
23	I drive my car in or into the city.*	-0.16	0.98	-0.24	0.98
24	I buy beverages in cans.*	-0.18	1.01	-0.26	1.02
25	I buy bleached and colored toilet paper.*	-0.21	1.02	-0.28	1.02
26	In the winter, I keep the heat on so that I do not have to wear thick clothing.*	-0.27	0.93	-0.34	0.96
27	I use fabric softener with my laundry.*	-0.28	1.04	-0.35	1.02
28	I buy seasonal produce.	-0.44	0.99	-0.52	1.01
29	In winter, I turn down the heat when I leave my apartment for more than 4 hours.	-0.49	0.98	-0.56	0.98
30	I drive in such a way as to keep my fuel consumption as low as possible.	-0.51	0.97	-0.59	0.98
31	I use an oven cleaning spray to clean my oven.*	-0.54	1.03	-0.61	0.99
32	I own energy efficient household devices.	-0.74	0.96	-0.81	0.95
33	I drive to the location where I want to go for a walk.	-0.87	1.02	-0.94	1.02
34	I put dead batteries in the garbage.*	-0.94	1.01	-1.01	1.02
35	I bring empty single-use bottles to a recycling bin.	-1.07	1.04	-1.14	1.02
36	In nearby areas up to 30 kilometers (=20 miles), I use public transportation or ride a bike.	-1.13	1.00	-1.21	1.04
37	In hotels, I have the towels changed daily.*	-1.18	0.87	-1.26	0.93
38	I wash dirty clothes without prewashing.	-1.19	1.12	-1.27	1.04
39	I use a clothes dryer.*	-1.25	0.99	-1.33	1.01
40	I kill insects with a chemical insecticide.*	-1.30	0.93	-1.38	0.96
41	I use a chemical air freshener in my bathroom.*	-1.56	0.98	-1.63	0.98
42	After meals, I dispose of leftovers in the toilet.*	-1.79	1.04	-1.87	1.02
43	I reuse my shopping bags.	-2.62	0.92	-2.70	0.98
44	I ride a bicycle or take public transportation to work or school.	-2.79	1.05	-2.87	1.04
45	After a picnic, I leave the place as clean as it was originally.	-3.36	0.86	-3.44	1.00

Note: δ indicates the difficulty of an item expressed in logits; the more negative a logit value, the easier the particular behavior is and vice versa. Logits represent the natural logarithm of the item engagement/nonengagement ratio. *MS* represents item fit as a mean square (MS) value. The subscript *one* indicates findings from the one-dimensional calibration of the items, whereas the subscript *two* refers to those from the two-dimensional model. *Items represent a negative attitude. Prior to the statistical analysis, the coding of these items was reversed.

Table 2.2: 34 water conservation attitude items

	Water Conservation Attitude	δ_{one}	MS_{one}	δ_{two}	MS_{two}
1	I shower for more than 3 minutes.†*	3.21	0.92	3.36	1.04
2	I rinse vegetables under running water.†*	2.21	1.28	2.35	1.03
3	I have bought or informed myself about flow regulators.†	2.01	1.09	2.15	1.05
4	I reuse wastewater, e.g. for irrigating plants or cleaning the floor.†	1.97	1.08	2.10	1.06
5	I have bought or informed myself about faucet aerators (device added to tap which spreads the water stream into many little droplets).†	1.91	1.15	2.04	1.01
6	I reuse rainwater, e.g. for irrigating plants or cleaning the floor.†	1.78	0.95	1.92	1.01
7	I have bought water-efficient plants for my room or garden.†	1.73	1.05	1.87	0.99
8	I check for plumbing leaks (e.g. toilet, faucets, showerhead).†	1.00	1.02	1.11	0.99
9	I have bought or informed myself about a certified water-efficient dishwasher.†	0.68	0.95	0.79	0.97
10	At home, we have water-efficient showerheads installed.†	0.56	1.02	0.67	1.03
11	I rinse the dishes under running water.†*	0.50	0.99	0.61	0.99
12	Cleaning the stairwell/balcony/floor/yard without water (e.g. broom, vacuum cleaner).	0.38	1.04	0.48	0.92
13	Showering for more than 3 minutes.*	0.37	1.06	0.47	0.97
14	Reusing wastewater, e.g. for irrigating plants or cleaning the floor.	0.23	0.96	0.33	0.97
15	I have bought or informed myself about a certified water-efficient washing machine.†	0.12	0.95	0.22	1.03
16	Rinsing vegetables under running water.*	0.03	1.11	0.13	0.94
17	I fix leaks immediately (myself or with professional help).†	-0.04	1.04	0.07	0.99
18	Reusing rainwater, e.g. for irrigating plants or cleaning the floor.	-0.08	0.93	0.02	0.90
19	Informing oneself about water conservation techniques is.	-0.42	0.90	-0.34	1.08
20	Checking for plumbing leaks (e.g. toilet, faucets, showerhead).	-0.59	1.02	-0.51	1.01
21	I use the water saving button of my dual flush toilet.†	-0.76	0.94	-0.68	1.00
22	Rinsing the dishes under running water.*	-0.99	1.09	-0.92	1.10
23	Searching for water saving opportunities at home.	-1.00	0.88	-0.93	0.94
24	I turn off the water while brushing teeth or soaping up in the shower.†	-1.03	0.98	-0.96	1.05
25	Fixing leaks immediately (oneself or with professional help).	-1.14	0.95	-1.08	0.93
26	Using the water saving button of a dual flush toilet.	-1.21	0.88	-1.15	0.97
27	Taking a shower instead of taking a bath.	-1.24	1.03	-1.18	0.96
28	Turning off the water while brushing one's teeth or soaping up in the shower is.	-1.43	0.92	-1.38	1.14
29	Investing in water saving devices.	-1.48	0.87	-1.42	0.97
30	I prefer to shower rather than to take a bath.†	-1.60	1.05	-1.54	0.98
31	I fill the dishwasher completely before usage.†	-1.88	1.00	-1.83	1.06
32	Filling the dishwasher completely before usage.	-2.17	0.89	-2.12	1.02
33	I fill the washing machine completely before usage.†	-2.24	0.99	-2.20	1.01
34	Filling the washing machine completely before usage.	-2.47	0.80	-2.43	0.93

Note: δ indicates the difficulty of an item expressed in logits; the more negative a logit value, the easier the particular behavior is and vice versa. Logits represent the natural logarithm of the item engagement/nonengagement ratio. *MS* represents item fit as a mean square (MS) value. The subscript *one* indicates findings from the one-dimensional calibration of the items, whereas subscript *two* refers to those from the two-dimensional model. † Items are behavioral self-reports, whereas all others are evaluative statements with two answer choices (unimportant/important). *Items represent a negative attitude. Prior to the statistical analysis, the coding of these items was reversed.

5="very often" including an option for "not applicable". Responses in the latter format were recoded into a dichotomous structure that collapsed "never", "seldom", and "occasionally" into "unreliable ecological engagement" and "often" and "very often" into "reliable ecological engagement". 17 negatively framed items were reverse keyed beforehand. A Rasch-type model was applied to calibrate the measure (Bond & Fox, 2007). In line with previous such calibrations (e.g. Byrka 2009), a weighted maximum likelihood approach was

used to derive person scores and accommodate missing values and "not applicable" answers (11.2% of all responses). The separation reliability of the 45 environmental attitude items was acceptable (r_{env}=.78).

Water conservation attitude was assessed with 34 items that asked about individual water conservation actions within the household (see Table 2.2). The composition of this measure was based on various previously applied water conservation scales (e.g. Dolcinar et al., 2012; Mondéjar-Jiménez et al., 2011). Six items concerned behavioral self-reports (e.g. "I have bought water-efficient plants for my room or garden") with a dichotomous response format (yes/no) and 12 behavioral self-reports with answer choices presented as a 5-point frequency scale ranging from 1="never" to 5="very often", including a "not applicable" option. The remaining 16 items (items 19-34) presented evaluative statements about water consumption behavior (e.g. "Investing in water saving devices") with two answer choices ("unimportant" and "important"). Analogous to the environmental attitude measure, all responses were collapsed into a binary format, the negative items were reverse keyed, and the person scores were determined with a weighted maximum likelihood approach. Missing data and "not applicable" answers accounted for 7.1% of all possible responses. The water conservation measure had a separation reliability of r_{wc}=.75.

2.2.3 Statistical measurement framework and analysis

Analyzing the dimensionality of water conservation attitude and environmental attitude requires a solid theoretical basis. We aimed to investigate the goodness of fit of two models: one representing these constructs with two separate latent dispositions (a two-dimensional model) and one representing them with a joint underlying disposition (a one-dimensional model). The statistical measurement framework that we used was the so-called Rasch model. It formally describes the relation between a person's attitudinal disposition (e.g. environmental attitude) and the item difficulties (Bond & Fox, 2007):

$$\ln\left(\frac{p_{ki}}{1-p_{ki}}\right) = \theta_k - \delta_i$$

The natural logarithm of the ratio of person *k's* probability of engagement (p_{ki}) and nonengagement in behavior *i* $(1 - p_{ki})$ is given by the difference between

k's level of attitude (θ_k) and the difficulty of behavior *i* (δ_i). In this mathematical representation, people are distinguishable on the basis of their degree of aspiration toward a particular goal, whereas behaviors differ with respect to their "engagement costs". For each person, the specific transitive order of behavioral engagement probabilities indicates the degree of attitude (DeFleur & Westie, 1963). Note that well-known technical problems that can occur in factor analytical approaches, when behaviors are involved, can be overcome by applying the Rasch model (Kaiser & Byrka, 2011).

To compare the one-dimensional with the two-dimensional model, we used the multidimensional random coefficients multinomial logit model (MRCML; Adams, Wilson, & Wang, 1997). The MRCML model restricts each item to loading on only one dimension, here either water conservation attitude or environmental attitude. Thus, the two-dimensional model is solely a conceptual construct, i.e. multidimensionality does not exist on the item level. Figure 2.1 illustrates the conceptual difference between the two models.

2.3 Results

The results are presented in three parts. First, we describe fit statistics (person and item values) for the two separate models for environmental attitude and water conversation attitude. Second, we describe the model fit for the one-dimensional model of one underlying environmental disposition (see Figure 2.1). Third, we present the general model fit (the G^2 fit statistic), the correlation coefficients, and the residuals that resulted from the comparison of the models.

For the two-dimensional model, the calibration of the environmental attitude scale yielded a separation reliability of r_{env}=.78, i.e. respondents could be distinguished quite well on the basis of their pro-environmental behavioral performance. Due to the relatively large sample size (*N*=760), we relied on the mean square (*MS*) statistic weighted by the item variance for assessing model fit. The strength of the *MS* statistic is that it reflects the relative discrepancy in the variation between model prediction and observed data independent of the sample size. The average mean square fit statistic was $M(MS_{items})$=1.00, and the corresponding standard deviation was $SD(MS_{items})$=.25. Table 2.1 shows the full list of environmental attitude items ordered by item difficulty (δ). The greater

the value, the more difficult the behavior was to perform. An almost equal share of positive (21) and negative (23) values suggests that the GEB scale provided an appropriate measure of environmental attitude in the given sample. The subscripts "one" and "two" were used to distinguish between the values obtained for the one-dimensional and two-dimensional models. Moreover, the MS values of all of the 45 environmental attitude items fell within the range of .80 – 1.20. Hence, all of the items predicted the variability in the data within the range of plus or minus 20%, which is commonly recognized as the acceptable range (Wright, Linacre, Gustafson, & Martin-Lof, 1994).

For water conservation attitude, the scale calibration yielded a separation reliability of r_{wc}=.75. The average item mean square was $M(MS_{items})$=.99, and the corresponding standard deviation was $SD(MS_{items})$=.27. All water conservation items were ordered by item difficulty (δ) and displayed in Table 2.2. Similar to the items for environmental attitude, almost half of the water conservation items had positive δ-values (16 out of 34), and no item mean square value fell outside the acceptable range. In sum, both scales showed good fit statistics and, thus, were valid measurement instruments.

For the one-dimensional model, calibrating all 79 items on one scale resulted in a separation reliability of r=.85. This value exceeded the separation reliability for the environmental attitude scale (r_{env}=.78) and the water conservation scale (r_{wc}=.75). However, this difference could be partially explained by the greater number of items used in the composite scale. Tables 2.1 and 2.2 show the item difficulties and mean square values for the one-dimensional model in the first and second columns. In total, the average mean square value was $M(MS_{items})$=1.00, and the corresponding standard deviation was $SD(MS_{items})$=.05. Thus, the one-dimensional model showed a much smaller variability in person values than the two-dimensional model. Of the 79 items, only two had mean square values that fell outside the acceptable range of .80 – 1.20. The average *MS* fit statistic, this time for persons, was $M(MS_{person})$=1.00, and the corresponding standard deviation was comparatively narrow as well ($SD(MS_{person})$=.20), hence reflecting that the participants' responses provided an excellent match with the expectations of the Rasch model.

Both the one-dimensional and two-dimensional models showed acceptable fit statistics. In order to determine which model was statistically superior, we first

examined the correlation between the environmental attitude scale and the water conservation attitude scale. A value of ρ=.51, or ρ_{corr}=.95 when corrected for measurement error attenuation, indicated a substantial overlap between the two constructs. Consequently, the discriminant validity between the two scales could be impaired. To assess general model fit, we used the G^2 fit statistic. For the two-dimensional model with 34 items loading on the water conservation attitude dimension and 45 items loading on the environmental attitude dimension, the model fit was $G^2(82)$=56,493. When all 79 items were modeled as a single dimension, the fit was $G^2(80)$=56,652. For both models, the value of the fit statistic was reasonable. However, the data fit the two-dimensional model significantly better than the one-dimensional model, $\Delta G^2(2)$=159 (p<.01). Despite being statistically significant, however, the difference in model fit was marginal in size and therefore needs to be treated with caution with regard to the discrimination of the two attitudinal concepts.

To examine the practical relevance of our result, we compared the residuals of the one- and two-dimensional models. A model is regarded as superior, if the absolute values of the differences between the actual responses and the expected values are smaller for this model than the values obtained for other solutions (for a similar approach, see Kaiser & Wilson, 2004). The average residuals for the one-dimensional model were $M(RES_{one})$=.34, whereas $M(RES_{two})$=.33 for the two-dimensional model. Thus, the latter model fit .01 units closer to the data on average. With respect to prediction, this means that if the actual questionnaire response was a 1 (i.e. positive engagement), and the one-dimensional model predicted an expected value of p=.66, then, on average, the two-dimensional model would anticipate a value of p=.67. To be precise, the one-dimensional model was statistically inferior to the two-dimensional model. However, the differences in model fit and prediction were marginal.

2.4 Discussion

Promoting the responsible use of water has become a central strategy for addressing the problem of growing water demand and regional scarcity. Without meeting the water needs of people, plants, and other living species, sustainable development is jeopardized. As an extension of previous work (e.g. Corral-Verdugo et al., 2008; Mondéjar-Jiménez et al., 2011; Willis et al., 2011), this

study investigated the attitudinal dimension behind water conservation, in particular, to which degree water conservation attitude and environmental attitude overlap. It further contributes to the discussion of the attitude-behavior relation in the environmental domain and the measurement of water conservation.

Traditionally, water conservation was measured with a set of behaviors that represent various engagement options (e.g. see Dolcinar et al., 2012; Sarabia-Sánchez, Rodríguez-Sánchez, & Hyder, 2014). However, studies have yet to investigate the existence of a water conservation attitude, which would represent moral, prosocial tendencies to protect water as a resource, a deliberate avoidance of wasteful water use, and the belief that it is important to minimize one's overall personal consumption of water. The Rasch model calibration of the water conservation items yielded a separation reliability of r_{wc}=.75 and acceptable item fit statistics (see Table 2.2). Thus, we were able to obtain reliable performance values that represented a person's tendency to engage in water conservation activities. As any act of conservation requires a person to overcome certain costs such as effort, time, or monetary spending, such aptitude or competence values can be interpreted as the intrinsic motivation, or more specifically, a person's water conservation attitude, which underlies such activities. Hence, successfully using the Rasch model enabled us to be the first ones to describe people's engagement in water conservation as a stable disposition, and thus, measure a person's water conservation attitude.

Exploring the role of pro-environmental dispositions as an attitudinal predictor of engagement in water conservation actions, we tested the degree to which water conservation attitude overlaps with environmental attitude. An almost perfect correlation (ρ_{corr}=.95) indicated that the two attitudes are virtually the same. Furthermore, a comparison of model fit and mean residuals showed the marginal, almost negligible statistical superiority of describing the attitudes as separate dimensions instead of a single one. The fact that the two models displayed almost equal mean residuals made a distinction between the attitudes practically irrelevant for predicting conservation behavior. In sum, our results reveal that water conservation attitude is almost fully congruent with environmental attitude.

In addition, water conservation and pro-environmental behavior resemble each other in terms of their prosocial nature, as any such behavior is in one way or another directed toward protecting the environment. Thus, a person with a high degree of environmental attitude is likely to engage in pro-environmental behavior and, taking into consideration the almost perfect overlap in attitudes, such a person is also likely to show a high water conservation commitment. From this theoretical perspective, it is reasonable to regard water conservation as one of several pro-environmental behavioral dimensions, such as energy saving and recycling, that are all rooted in environmental attitude.

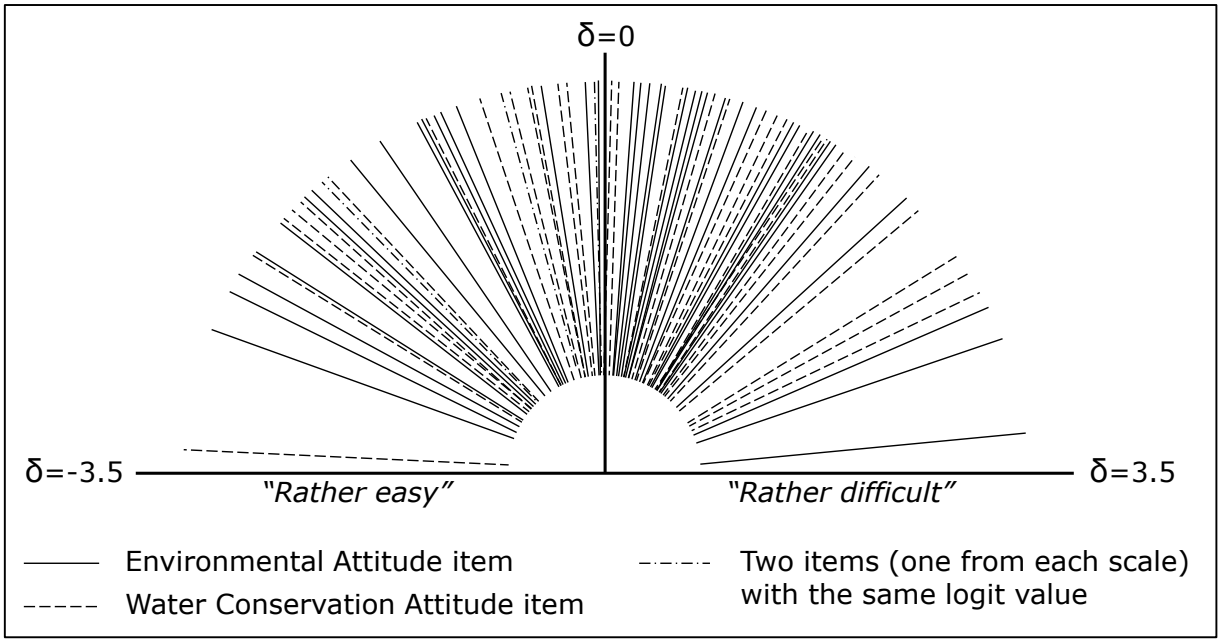

Figure 2.2: The difficulties of all 79 items expressed in logits for the one-dimensional model

The practical implications of our research findings are directed at researchers, water managers, and policy makers alike. Managing the demand for water is often regarded as a high political priority, yet financial and human resources are not always sufficiently available. Moreover, it is common to treat water conservation as an isolated field with little overlap with other environmental objectives. However, there is little evidence to support this practice. As our research indicates, not only is water conservation attitude almost completely conceptually congruent with environmental attitude, but the respective

behaviors are also similarly difficult to perform. That is, a difficulty ranking of all 79 items from both attitude scales yielded a diverse and equally distributed spectrum (see Figure 2.2). Thus, water conservation initiatives could be easily integrated into holistic pro-environmental programs aimed at increasing people's commitment to protecting the environment.

Despite such promising conclusions, our research also has some notable shortcomings. First, our study is based on a student sample and is thus not representative of the entire population of Germany. Despite this constraint, the key variables showed a sufficient degree of variability (see measures). Moreover, there is no reason to expect differences in water conservation attitude and environmental attitude between students and other societal groups. Second, it is known that systematic response patterns may occur with self-administered questionnaires. However, previous studies have demonstrated (see Kaiser & Wilson, 2000) that recoding the original answers into a dichotomous format provides an appropriate strategy for avoiding systematic response biases. Third, using behavioral self-reports always bears the risk of an incorrect measurement of actual behaviors. In this respect, we refer to previous studies in the environmental domain that have indicated only small discrepancies between self-reported and observed actions (e.g. Kaiser, Frick, & Stoll-Kleemann, 2001). Future research could address this issue by measuring conservation attitudes along with actual consumption data. However, observing behavior inside people's homes remains a challenging task.

In sum, our results provide a new perspective on the attitudinal dimension behind water conservation and propose innovative solutions for managing water conservation. The joint latent motivation behind water conservation and pro-environmental behaviors offers vast synergies for behavioral change approaches, as the outcomes of distinct water conservation and environmental campaigns may be realized more efficiently by changing people's general environmental attitude instead. We believe that the results of our study can have a significant impact on the methods applied for promoting water conservation and environmentalism at large.

3 Environmentalism vs. Honesty-Humility: How to Measure People's Moral Personality

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Abstract

The present research compares two well-established measures of altruistic, pro-social, or moral tendencies in their ability to predict moral behavior. Addressing facets of frugality, parsimony, and modesty, Honesty-Humility suggests acts of sacrificing personal amenities for no direct social benefit. Similarly, environmentalism indicates more cooperative, morally virtuous, and prosocially oriented behavior. Thus, we aim to demonstrate that a well-established measure of environmentalism substantially overlaps with Honesty-Humility, and above and beyond, can be used to forecast people's active engagement in domestic water conservation, i.e. acts which generally do not promise any personal benefits and, thus, are used as a proxy for a person's moral personality. Our results are based on cross-sectional survey data from a convenience sample from Germany (N=760). Environmentalism (r=.46) had a greater overlap with water conservation than Honesty-Humility (r=.17). A hierarchical regression analysis revealed that environmentalism is a better suited predictor of people's moral personality than Honesty-Humility.

3.1 Introduction

"Turn off the water, when you brush your teeth" is one of many phrases children in Germany use to grow up with. Over the last decades, Germans have developed an extraordinary attitude towards the resource water. Today, water conservation at home is very common, yet there are great differences in the degree to which people engage in such actions. Some prefer to invest in water conservation technologies, whereas others tend to save small amounts on a daily basis. Unlike other natural resources, fresh water is not scarce in Germany. Currently, less than 3% of the annual water recharge is used as potable water for domestic use (UBA, 2014). That means that there is no immediate impact of a person's water consumption on another person's water availability. These particular conditions prevent water consumption in Germany to be classified as a social dilemma situation.

Most households in Germany face a two-tier pricing system with a fixed and a variable component. The monthly base rate aims to recover system network maintenance costs and accounts for about 80% of the water bill (UBA, 2013). In addition, a volumetric rate is added, which depends on actual consumption. Even though the volumetric charge increased from 1.18 EUR/m3 in 1992 to 1.92 EUR/m3 in 2011, the water bill of an average consumer is currently around 8.25 EUR per month (UBA, 2013). Comparing potential monetary savings as a result of individual water conservation engagement with the average monthly disposable income of a person – according to the Germany social security system – of around 1,707 EUR (own calculations based on Deutsche Rentenversicherung, 2015), it becomes obvious that conserving water only bears negligible monetary incentives.

Strictly speaking, water conservation in Germany does not provide any benefits for oneself, any other person, or the environment. Instead, even negative consequences can occur. For instance, in some regions water utilities even call for higher consumption to avoid formation of germs and material corrosion due to a low flow rate in the water pipes. In other regions, the decrease in consumption leads to a steady increase in the groundwater table, which threatens residential houses (Dallmus, 2013). In sum, water conservation does not provide any benefits oneself or other people can enjoy. Thus, water conservation in Germany does not represent prosocial behavior and is not

guided by altruistic motives (cf. Batson & Powell, 2003). Instead, it can be classified as purely moral behavior, because it is solely guided by a person's understanding of what is good or bad independent of any costs or benefits (Thøgersen, 1996). Yet, what is a good instrument to measure such moral behavior, i.e. an instrument, which explains a substantial share of variation in moral behavior?

In this paper, we make an attempt to measure people's moral personality by means of two well-established concepts, environmentalism and Honesty-Humility. Both concepts have in common that they have been empirically linked to cooperative, pro-social, and moral dispositions (e.g. Kaiser, Hübner, & Bogner, 2005; Hilbig, Zettler, Moshagen, & Heydasch, 2012). Environmentalism describes the propensity of an individual to engage in ecological behaviors. It is measured by the General Ecological Behavior (GEB) scale (Kaiser & Wilson, 2004) which encompasses 50 ecological behaviors in its original version. Such selfless prosocial acts reflect moral dispositions (e.g., Stern, 2000). The personality factor Honesty-Humility is taken from the revised HEXACO personality inventory (HEXACO-PI-R) scale (Lee & Ashton, 2004) and includes 32 statements regarding fairness, modesty, sincerity, and greed-avoidance. In that sense, both concepts are conceptually suitable to serve as predictors of moral behavior. Based on questionnaire data from 760 German university students, we compare the overlap of environmentalism and Honesty-Humility, respectively, with water conservation. First, correlation coefficients are determined and, second, OLS regression analysis is used to evaluate the share of explained variation in water conservation behavior by environmentalism and Honesty-Humility.

In the following, we briefly review the literature on environmentalism and Honesty-Humility with a particular focus on their relationship with moral dispositions. Then, our approach to measure environmentalism by the GEB scale is introduced, results are presented, and policy and research implications are discussed.

3.1.1 Honesty-Humility

As an extension of the traditional five-factor model of personality structure, Ashton and Lee (2007) proposed the so called HEXACO model, which describes the human personality by means of six distinct dimensions. While virtually representing the original five-factors, the HEXACO model proposes an additional factor called Honesty-Humility, which represents facets such as being fair, modest, genuine, and cooperative. Thus, a high level of Honesty-Humility suggests that the person acts modest and relinquishes situations of exploitation, even when the risk of retaliation is low (Ashton, Lee, & de Vries, 2014). In that sense, traits underlying water conservation at home are similar to the lexical space of Honesty-Humility, as defection from the moral norm – i.e. low levels of water conservation – cannot be observed by others. Hence, high levels of water conservation would indicate strong morality. So far, research has linked Honesty-Humility to general ecological behavior (Hilbig et al., 2012). Given that ecological behavior and water conservation are both associated with unselfish and prosocial orientations (e.g. Cialdini, 2003; Corral-Verdugo & Frias-Armenta, 2006; Kaiser & Byrka, 2011; Stern, 2000), we expect Honesty-Humility to be closely related to water conservation as well. For more information on the HEXACO-PI-R, see http://hexaco.org.

3.1.2 Environmentalism

Environmentalism is generally understood as a class of behaviors which contribute to greater environmental protection and conservation (Axelrod & Lehman, 1993), or at least aim to harm the environment as little as possible (Steg & Vlek, 2009). Consequently, a committed environmentalist is likely to engage in numerous, possibly diverse ecological behaviors (Kaiser et al., 2010). Yet, such behaviors do not occur spontaneous, situation-dependent, and context-specific, but are motivated by a stable latent trait, namely environmental attitude (Kaiser & Byrka, 2011). Interestingly, Kaiser (2006) revealed that environmentalism is not driven by personal interests and, thus, claimed that it represents a person's prosocial nature. In conservation psychology, it is undisputed that selfless prosocial motives are central forces behind moral behavior (e.g. Stern, 2000). In line with these conceptualizations, previous research indicated that moral motives are in fact represented by

environmental attitude (Kaiser, Hübner, & Bogner, 2005). Thus, we expect environmentalism to be a suitable predictor of water conservation.

3.2 Methodology

3.2.1 Participants and procedures

The dataset is composed of information from a questionnaire survey among undergraduate students at Humboldt-University of Berlin, Germany, in fall 2012. Within each of five different departments (agricultural sciences, American studies, business, law, mathematics), one class was randomly selected for the survey. The questionnaire was distributed in class and collected afterwards. Most of the participants needed between 15 and 30 minutes to complete the questionnaire. Due to voluntary participation, some students did not take part and left the room. There was no incentive for participation in the form of course credit or a lottery for prizes. The questionnaire was completely anonymous and the lecturer did not participate in the procedure. Therefore, the procedure reduced the risk of any social desirability bias.

In total, 760 valid questionnaires were collected: law (n=343, 45.1%), business (n=171, 22.5%), agricultural sciences (n=155, 20.4%), mathematics (n=53, 7.0%), and American studies (n=38, 5.0%). The amount of female students was 57.2% and all students were enrolled in an undergraduate program. Thus, is can be assumed that most participants were between 18 and 22 years old.

3.2.2 Measures

Water conservation was assessed with 34 behavioral items, which indicate people's engagement in water conservation actions within their household. The item selection was based on previously applied water conservation scales (e.g. Berk, Schulman, McKeever, & Freeman, 1993; Dolcinar et al., 2012; Mondéjar-Jiménez et al., 2011). Six items are framed as behavioral self-reports (e.g. "I have bought water-efficient plants for my room or garden") with a dichotomous response format (yes/no), whereas 12 behavioral self-reports had answer choices presented as a 5-point frequency scale ranging from 1="never" to 5="very often" including a "not applicable" option. The remaining 16 items

(items 19 - 34) presented evaluative statements about individual water consumption behavior (e.g. "Investing in water saving devices") with two answer choices ("unimportant" and "important"). In sum, the 34 items comprehensively reflect a person's water conservation engagement.

Before analyzing the data, the responses from the five-point frequency scale were collapsed into a binary format with "never", "seldom", and "occasionally" indicating "unreliable water conservation" and "often" and "very often" showing "reliable water conservation". All negatively framed items were reverse keyed. For the Rasch calculations, a weighted maximum likelihood approach was used (Bond & Fox, 2007), whereas percentage score values were calculated as the ratio of affirmed water conservation engagement and the total amount of applicable behaviors (34 items minus "not applicable" items). Missing data and "not applicable" answers accounted for 7.1% of all possible responses. The water conservation measure had a separation reliability of r_{wc}=.75.

Environmentalism was measured with a modified 45-item version of the well-established General Ecological Behavior (GEB) scale (Kaiser & Wilson, 2004). It is composed of ecological behaviors, which cover six sub-domains including consumerism, energy conservation, mobility and transportation, recycling, social behaviors, and waste avoidance. 15 items were framed in a yes/no response format, whereas the other 30 items offered a 5-point frequency scale ranging from 1 (never) to 5 (very often), including an option for "not applicable". Similar to the water conservation measure, responses from the frequency scale were recoded into a dichotomous structure, so that "never", "seldom", and "occasionally" were assessed as "unreliable ecological engagement" and "often" and "very often" as "reliable ecological engagement". 17 negatively framed items were reverse keyed beforehand. Missing values and "not applicable" answers accounted for 11.2% of all possible responses. A Rasch-type model using a weighted maximum likelihood approach was applied to yield person values for environmental attitude (Bond & Fox, 2007). Percentage score values were derived as well. The separation reliability of the environmentalism measure was r_{env}=.78.

Honesty-Humility was assessed with 32 items from the HEXACO PI-R (e.g. Lee & Ashton, 2004). Each of the four facets was represented by 8 items. A sample item for modesty was "I wouldn't want people to treat me as though I were

superior to them" and one for fairness is "I'd be tempted to use counterfeit money, if I were sure I could get away with it" (recoded). Calibration of the items was based on confirmatory factor analysis using Bartlett scores. The measure has a mean of M_{HH}=-.03, a standard deviation of SD_{HH}=1.07, and is quasi normally distributed. In order to test the robustness of the regular HH measure, also values for the short form (see Ashton & Lee, 2009) were used. The short form of the HH factor was only composed of 10 items. It had an almost perfect overlap (r=.93) with the original inventory.

3.2.3 Attitude measurement framework

It is crucial to understand how environmental attitude is conceptually related to ecological behavior. Our approach is based on the so-called Campbell paradigm (cf. Campbell, 1963), which assumes an axiomatic instead of a causal relation between attitude and behavior (Kaiser et al., 2010). Behavior is regarded as a representation of an underlying attitude, whereas people usually choose from various behavioral options to realize their goal (e.g. environmental protection). Thus, people differ by the extent to which they perform increasingly demanding behaviors (Campbell, 1963). A person, who is willing to incur greater sacrifices than others to protect the environment, is expected to have a higher level of environmental attitude (Kaiser & Wilson, 2004). These difficulties between individual behaviors become overt in their respective engagement frequencies in a situational context (i.e. socio-cultural, geographic, or political), which is the same for all people in that location. As people generally choose their behaviors prudently, a rational person who engages in a certain behavior is also likely to engage in any other behaviors that are related to the same objective, but are less demanding.

A common operationalization of this theoretical framework is done by applying a Rasch model. It formally relates a person's level of attitude to each behavior's engagement difficulty (Bond & Fox, 2007):

$$\ln\left(\frac{p_{ki}}{1-p_{ki}}\right) = \theta_k - \delta_i$$

The natural logarithm of the ratio of person k's probability of engagement (p_{ki}) and nonengagement in behavior i $(1 - p_{ki})$ is given by the difference between

k's level of attitude (θ_k) and the difficulty of behavior *i* (δ_i). People can be distinguished based on their level of esteem for a particular objective, while behaviors differ with respect to their engagement difficulty. Regarding measurement of latent constructs involving behaviors, technical problems can be overcome by applying the Rasch model in contrast to traditional factor analytical approaches (Kaiser & Byrka, 2011).

3.3 Analysis and results

The objective of this study was to compare two established measures in predicting moral behavior. For our analysis, we first calculated the Pearson correlation coefficient between the two measures, respectively, and water conservation to assess their linear overlap. Second, we used OLS regression analysis to test the explanatory power of each regressor, separately and in a joint model.

Table 3.1: Pearson correlation coefficients for water conservation, environmentalism, and Honesty-Humility

	M (SD)	*N*	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. WC (Rasch)	.12 (.87)	760	1									
2. WC (Score)	.54 (.14)	760	.99**	1								
3. ENV (Rasch)	-.05 (.77)	760	.51**	.51**	1							
4. ENV (Score)	.50 (.13)	760	.51**	.51**	.99**	1						
5. HH	-.03 (1.07)	594	.27**	.27**	.38**	.39**	1					
6. HH (short form)	-.01 (1.15)	661	.25**	.25**	.36**	.37**	.93**	1				
7. HH: Fairness	-.02 (1.17)	655	.19**	.19**	.18**	.18**	.52**	.39**	1			
8. HH: Greed-avoidance	.01 (1.11)	708	.19**	.19**	.40**	.41**	.83**	.83**	.22**	1		
9. HH: Modesty	.00 (1.14)	701	.21**	.22**	.22**	.23**	.84**	.76**	.35**	.54**	1	
10. HH: Sincerity	.01 (1.24)	692	.24**	.25**	.26**	.27**	.68**	.57**	.35**	.43**	.44**	1

Note: M - mean; SD - standard deviation
WC - water conservation; ENV - environmentalism; HH - Honesty-Humility
*** p<.01*

As a first step, the Pearson correlation coefficients between water conservation and the two predictors environmentalism and Honesty-Humility were calculated. Clearly, environmentalism shares more information with water conservation ($r_{wc,env}$=.51) than Honesty-Humility ($r_{wc,hh}$=.27), though both measures significantly overlap with water conservation (see Table 3.1). In order to test for the robustness of this result, we additionally compared the overlap of water conservation with the short form of the Honesty-Humility personality inventory and each of the four facets. As Table 3.1 shows, none of those modifications

resulted in a higher correlation coefficient with water conservation than environmentalism. Even modifying the calibration method for the measures of environmentalism and water conservation, i.e. using percentage score values instead of a Rasch-type calibration, only changed the coefficients marginally. Therefore, in the following regression analysis only Rasch model values were used as measures for environmentalism and water conservation.

After obtaining values for the linear overlap between the concepts, a regression analysis was used to test for differences in explanatory power. Table 3.2 gives an overview of all regression models. Note that all regression coefficients are standardized to allow for a better comparison between each regressor. Model 1 and Model 2 assessed to which degree each individual concept predicts water conservation. In Model 3, the joint effect of environmentalism and Honesty-Humility was determined. Model 4 and 5 constituted alterations of Model 3, i.e. Honesty-Humility was replaced with its short form and jointly with its four facets as regressors in addition to environmentalism.

Table 3.2: OLS regression analysis results for water conservation (Rasch) as dependent variable

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Environmentalism (Rasch)	.51**		.49**	.51**	.52**
Honesty-Humility		.27**	.09*		
Honesty-Humility (short form)				.07	
Honesty-Humility: Fairness					.07
Honesty-Humility: Greed-avoidance					-.13**
Honesty-Humility: Modesty					.11*
Honesty-Humility: Sincerity					.10*
Adjusted R^2	.26	.07	.28	.29	.30

Note: standardized coefficients; Huber-White standard errors
*** p<.01; * p<.05*

It becomes obvious, that both environmentalism and Honesty-Humility are significant predictors of water conservation (Model 1 and Model 2). This result is not surprising, as the correlation analysis already indicated this outcome. Nevertheless, the difference in explained variation is substantial. Model 1 shows that environmentalism alone explains 26 percent of variation in water

conservation. In contrast, Honesty-Humility accounts for only 7 percent of variation in water conservation.

In Model 3, environmentalism and Honesty-Humility were jointly used as regressors. Again, both determinants had significant coefficients. Yet, using standardized coefficients allowed for a relative comparison. We found that environmentalism had a coefficient of b_{env}=.49, whereas Honesty-Humility had a coefficient of b_{hh}=.09. Similar to the correlation analysis, robustness checks were performed substituting the original Honesty-Humility measure with its short form (Model 4) and with its four individual facets (Model 5). The coefficient for the Honesty-Humility short form turned out insignificant, when used as regressor together with environmentalism. Despite resulting in the highest R^2-value of the models calculated, none of the four Honesty-Humility facets yielded a coefficient greater than the one for environmentalism.

3.4 Discussion

This paper investigated two potential predictors, namely environmentalism and the personality factor Honesty-Humility, of moral behavior. Unlike in other countries, where the water bill makes up for a larger share of disposable income and, thus, confounds the motivation to engage in water conservation, such behavior in Germany can be classified as a moral one. Previous research indicated that both predictors were closely associated with prosocial, altruistic, and moral tendencies (e.g. Corral-Verdugo & Frias-Armenta, 2006; Hilbig et al., 2012; Kaiser et al., 2005). A comparison of correlation coefficients and a subsequent regression analysis indicated that environmentalism is a better predictor of moral behavior than Honesty-Humility. This result is interesting, as Honesty-Humility is a well-established personality factor, which represents modest, fair, and cooperative tendencies (e.g. Lee & Ashton, 2004). Environmentalism, however, describes people's behavioral realization of their environmental attitude, i.e. attitude towards environmental protection. Hence, this result reveals some crucial information about the underlying dispositions of environmental attitude. Our findings suggest that people, who tend to engage more in ecological behaviors than others, do so because they have a higher moral disposition.

This study was limited to two predictors of moral behavior. Needless to say, future research should build upon our findings to identify further moral predictors, which are superior to environmentalism. In addition, empirical studies could affirm the suitability of environmentalism using other moral behaviors than water conservation in Germany. Even an identical replication of this study with a different, more diverse dataset could yield important information on the external validity of our results.

In total, this paper contributes greatly to the social psychology literature. In particular, it sheds light on the many facets of moral behavior and how it can be measured. Looking at the topic from a different angle, the significant relationship between water conservation and Honesty-Humility suggests that this class of behavior may be even rooted in a person's personality. In other words, the way how people choose to engage in water conservation does not occur ad-hoc, but is driven by inherent manifested dispositions.

4 Water Conservation under Scarcity Conditions: Testing the Long-run Effectiveness of a Water Conservation Awareness Campaign in Jordan

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Abstract

This study investigates the effect of a media awareness campaign on water conservation behavior in Jordan, a country suffering from extreme water scarcity. Abu Tawfeer, a cartoon figure representing a typical Jordanian, appeared on various media outlets with the objective to change people's water conservation behavior by addressing three distinct awareness factors. Based on a representative sample (N=367) collected five years after the end of the campaign, the long-run effect of the campaign is measured. A multivariate instrumental variable regression analysis shows that the campaign had a marginal effect on water conservation behavior, yet only increased awareness of one factor (feeling of responsibility of individual people). The main novelties of our research are the rigorous methodological approach to examine the effect of a conservation campaign and being one of the first ones to comprehensively investigate the determinants of water conservation behavior in the Middle East.

4.1 Introduction

Jordan is one of the most water scarce countries in the world. For decades, people have suffered from infrequent and limited supply impeding social well-being and economic development. Massive population growth due to the influx of refugees during the first gulf war (1990-1991), the war in Iraq (2003), and the recent conflict in Syria has exacerbated the pressure on the country's water resources in the recent past. This has led to increased exploitation of surface water mainly from the Yarmouk and the Jordan River as well as groundwater tapping in Disi and Azraq. Despite these attempts to meet the growing demand, experts estimated the water deficit to reach 450 million cubic meters by 2025 (Haddadin, 2011). In order to combine efforts to address the water shortage, the national water strategy "Water for Life" (2008-2022) was introduced, which explicitly stresses the need for water conservation (MWI, 2009).

This holistic government approach was partially motivated by the former USAID-funded Water Efficiency and Public Information for Action Program (WEPIA) conducted between 2000 and 2005 (USAID, 2005). WEPIA's objectives included educating the public about the country's overall water predicament, creating a general water conservation ethic as well as increasing awareness and eliciting behavior change (OECD, 2014). A comprehensive media campaign was initiated to inform and educate the public. In particular, it emphasized the actual severity of the water situation, the need for individual contributions ("the solution starts with you") as well as the benefits to use concrete water-efficient technologies (USAID, 2005, p. iv).

The campaign used an animated cartoon figure called Abu Tawfeer, literally translated as "father miser" as recognizable icon. It represented a typical Jordanian who worked as a government employee and lived in an urban setting with his wife and son (Columbia University, 2010). Family composition, personality, and occupation were on purpose designed to resemble an average Jordanian man. Abu Tawfeer was featured on various media channels including 936 television spots, 354 radio spots, 75 billboards as well as SMS messages, mass mail, brochures, posters, and leaflets (USAID, 2005).

In order to measure the media campaign's impact, two studies were conducted by USAID immediately after its roll-out. Among 384 people interviewed by phone, more than 80% stated that they had seen an advertisement, whereas

out of 400 people personally interviewed, 42% confirmed they had seen a print advertisement (USAID, 2005). Five years after the end of the campaign (i.e. in 2010), a national survey showed that 60% of all respondents were still able to name water conservation methods, 45% were applying them, yet only 22% remembered the campaign's icon Abu Tawfeer (USAID, 2010). At first glance, it seems that the Abu Tawfeer campaign was successful in shaping people's water conservation behavior. However, these figures are solely descriptive, i.e. no causal link between the campaign and the outcomes was established. Thus, a methodologically sound analysis is yet to be conducted to determine the true relationship between the campaign and the variables it sought to influence. In detail, this includes the campaign's effect on water conservation awareness and actual behavior. This paper caters to this need by conducting a systematic and statistically sound estimation of the campaign's impact. In a broader sense, our results contribute to a better understanding of the determinants of water conservation behavior. In addition, this is one of the first systematic analyses of water conservation determinants in the Middle East, a region, in which many countries suffer from extreme water scarcity.

In the following, a literature review is performed to demonstrate the current knowledge on the effectiveness of water conservation awareness campaigns and factors, which influence the engagement in water conservation behavior. Based on this review, the aims of this study and its concrete hypotheses as well as the dataset and methodology are presented. The subsequent results section then provides the basis for an in-depth discussion on the study's policy implications and research contributions.

4.2 Literature review

4.2.1 Water conservation campaigns

Encouraging the public to participate in voluntary water conservation is a difficult but critical stage of any demand-side management campaign (e.g. Bruvold & Smith, 1988; Howarth & Butler, 2004; Lant, 1993). Traditionally, such campaigns were initiated in reaction to a current drought situation with the objective to temporarily curtail demand. Lately, water managers have started to stimulate voluntary responses to shape people's long-run awareness and

attitude towards water and water conservation practices to achieve a sustained conservation effect (e.g. Howarth & Butler, 2004; Ouda et al., 2013). By calling upon people's voluntary commitment, media campaigns are an alternative to changes in the water tariff or tariff system (Syme, Nancarrow, & Seligman, 2000).

So far, empirical studies have showed mixed results with respect to the effectiveness of water conservation campaigns. Baumann et al. (1998) found that public awareness campaigns reduce demand by 2-5%. A long-term effect was measured in Zaragoza, Spain, when a public education campaign led to a decrease in water consumption of 5.6% and an increase in awareness of 28% one year later (UK Environment Agency, 1999). Results from a study in the US showed that prevalent water scarcity increased the effectiveness of a campaign (Nieswiadomy, 1992). In contrast, Howarth and Butler (2004) found no significant effect on water demand after a concerted conservation effort including direct mailing, newspaper, radio advertisements, and posters took place.

Methodologically, two problems usually occur, when it comes to measuring the effects of a campaign. First, efforts to reduce residential water demand are often composed of a set of various instruments, of which an educational media campaign may be only one (e.g. Ouda et al., 2013). Thus, identification of the direct effect of such a campaign can be difficult. Second, substantial behavior change is often limited to the time span of the campaign. In other words, people engage in water conservation as long as they are reminded of by public media (Billings & Day, 1989). Thus, an assessment after the end of the campaign can elicit its long-run effectiveness. Yet, no water conservation campaign has been assessed in a comprehensive and systematic way, which accounted for such problems.

4.2.2 Determinants of water conservation behavior

In addition to such methodological obstacles, it is important to review the current knowledge of water conservation determinants. With respect to socio-demographic determinants findings are mainly ambiguous with respect to the variables' sign and strength of their impact. For instance, a person's age could

not be linearly related to water conservation behavior. It rather seems that certain life stages matter, as teenagers were found to care less about water conservation (e.g. Makki, Stewart, Panuwatwanich, & Beal, 2013; Mayer & DeOreo, 1999), whereas older people engaged more in water saving (e.g. Clark & Finley, 2007; Gregory & Di Leo, 2003; Olli, Grendstad, & Wollebaek, 2001; Wolters, 2014). With respect to income, some studies reported a positive impact on water conservation engagement (e.g. Lam, 2006; Renwick & Archibald, 1998), while others found the opposite (e.g. De Oliver, 1999; Gregory & Di Leo, 2003; Jeffrey & Gearey, 2006). Contradicting results were also found for education (e.g. Clark & Finley, 2007; De Oliver, 1999; Dolcinar et al., 2012; Gregory & Di Leo, 2003). Interestingly, joint analyses revealed that socio-demographic variables only explained ten percent of variation in environmental conservation behavior (e.g. Bamberg, 2003; Olli et al., 2001; Wall, 1995). In contrast, psychological variables are considered to have a much greater impact. For instance, Kaiser et al. (1999) showed that environmental attitude accounted for at least 50% in ecological behavior variance. Analogously to this finding, water conservation behavior is, thus, expected to be substantially determined by psychological factors (e.g. water conservation awareness). The respective literature is briefly reviewed in the following.

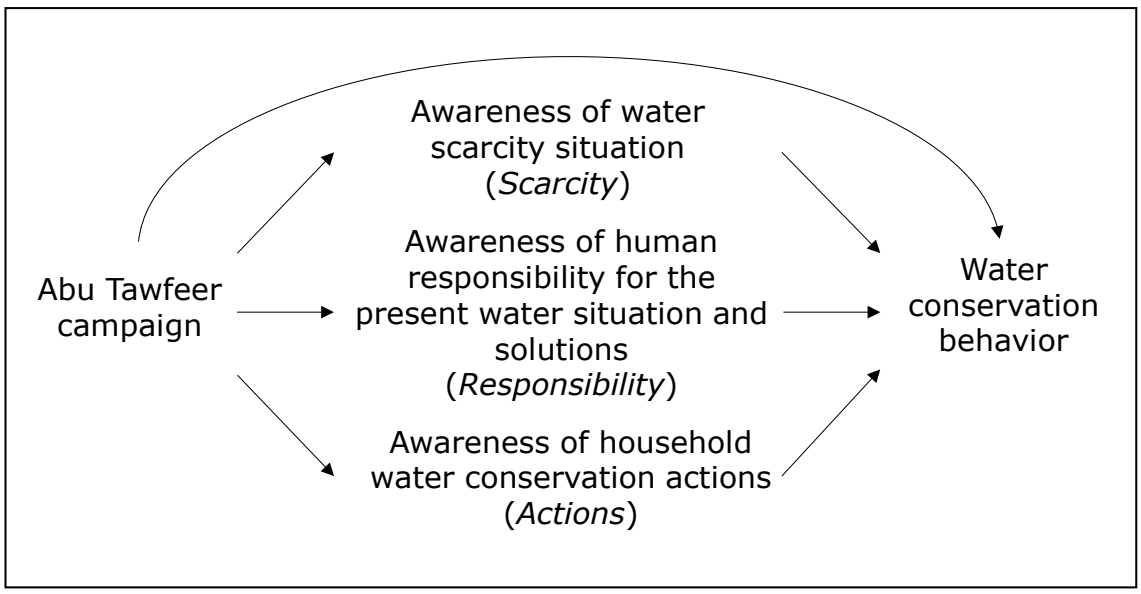


Figure 4.1: Conceptual model of the effects of the Abu Tawfeer campaign

Scholars have studied the impact of attitudes, concerns, and beliefs with respect to water conservation. Positive attitudes towards a specific water conservation behavior have been linked to stronger intentions to perform that very behavior (e.g. Harland, Staats, & Wilke, 1999; Lam, 2006; Trumbo & O'Keefe, 2001). Nevertheless, other researchers could not establish a significant relationship between water conservation attitudes and behavior (e.g. De Oliver, 1999; Gregory & Di Leo, 2003; Miller & Buys, 2008). Furthermore, water conservation behavior has been also linked to more general psychological concepts from the environmental domain. Studies showed that environmental beliefs (e.g. Clark & Finley, 2007; Corral-Verdugo et al., 2008), environmental awareness (e.g. Mondéjar-Jiménez et al., 2011), and environmental concern (e.g. Dolnicar et al., 2012; Willis et al., 2011) were significant predictors of water conservation. In that sense, the Abu Tawfeer campaign can be related to previous research, as its general objective was to change people's water conservation awareness and motivate behavior change.

4.2.3 Research objective and hypotheses

This research examined the effects of the Abu Tawfeer campaign in promoting water conservation in Jordan. One objective was to assess the campaign's impact on three water conservation awareness factors: people's awareness of the severity of water scarcity in Jordan, awareness of the role and responsibility of individuals for the present water situation and solutions to it (e.g. compared to institutional actors such as the Ministry of Water and Irrigation), and awareness of possible household water conservation behaviors. In addition, the direct impact of the campaign on actual water conservation behavior was investigated as well as its indirect effect via the awareness factors. A conceptual model of the analysis depicted in Figure 4.1 shows the relationship between the variables. Based on this model, the following hypotheses were derived:

H1a: *People who know about Abu Tawfeer perceive the water situation as more critical.*

H1b: *People who know about Abu Tawfeer perceive humans to be more responsible for the present water situation and solutions to it.*

H1c: People who know about Abu Tawfeer are more aware of possible household water conservation actions.

H2: People who know about Abu Tawfeer engage more in water conservation behavior.

4.3 Methodology

4.3.1 Data collection

The data was collected in 2010 as part of the Public Action for Water, Energy and Environment Project (PAP) administered by USAID in Jordan. PAP conducted a comprehensive survey on people's behavior, opinion, and problem awareness regarding water conservation, energy saving, and household waste disposal (USAID, 2010). For the purpose of our research, only the data concerning water conservation awareness and behavior (N=367) was used. To achieve representativeness, participants were selected by the random route method, i.e. each respondent had the same chance of taking part in the survey. Each selected household was visited in person by an interviewer. Only the person in charge of water, fuel, and household waste filled out the questionnaire.

4.3.2 Measures

Water conservation behavior was measured as the sum score of 16 distinct water conservation acts within the household (see Table 4.1). Respondents were asked to indicate, whether they engaged in the respective behavior (1="yes"; 0="no"). Thus, the measure does not differentiate between the behavior's volumetric savings potential, but rather estimates the amount of behaviors the person engaged in. Therefore, a greater sum score was associated with a higher water conservation engagement. Items included acts regarding avoidance of losses ("Fixing any leakage or broken pipes immediately") as well as confinement ("Taking shorter showers") or habitual acts ("Closing the faucet water while teeth brushing / dish washing"). All of these conservation behaviors are common in Jordan and appropriately represent the range of conservation possibilities of residential consumers.

The impact of the Abu Tawfeer campaign (*Abu Tawfeer*) was assessed as a binary variable with 1="I have heard about a cartoon character named Abu Tawfeer" and 0="I have not heard about a cartoon character named Abu Tawfeer". The three awareness variables represented key elements and objectives of the Abu Tawfeer campaign. First, awareness of the water scarcity situation (*Scarcity*) reflected people's general perception of the severity of the Jordanian water situation. Answers ranged from 1="Not a problem at all" to 4="A very critical problem", where 84% of all respondents perceived the water situation as a critical or very critical problem. Second, awareness of people's responsibility for the present water situation and solutions to it (*Responsibility*) was assessed as a composite score of four items. Two items represented the affirmed opinion that increased household demand leads to water scarcity. The other two indicated the respondents' perception that individual consumers should take actions to solve the problem and not only the water authorities (e.g. Jordanian Ministry of Water and Irrigation). Third, awareness of household water conservation behaviors (*Actions*) was measured as the sum score of 14 behaviors, which the respondents were asked, whether they heard of them.

Table 4.1: 16 Water conservation behavior items ranked by average endorsement

"What are you currently doing in order to save water?"	**Mean**	**Std. Dev.**
Using a bucket instead of a hose	.54	.50
Conducting regular maintenance on water pipes, tanks, fixtures, and/or toilet tanks	.53	.50
Using water saving devices	.38	.49
Fixing any leakage or broken pipes immediately	.24	.43
Closing the faucet water while teeth brushing/ dish washing	.19	.39
Washing vegetables in buckets instead of running water	.13	.34
Reusing gray water	.13	.33
Taking shorter showers	.13	.33
Owning an efficient automatic washing machine	.12	.33
Running full loads in washing machines / wash once a week	.08	.26
Placing a brick or a bottle in the toilet tank	.04	.20
Owning water efficient electrical appliances	.03	.17
Owning water efficient plumbing products	.03	.16
Having power spray attached to a hose	.02	.15
Collecting and using rain water	.01	.12
Planting plants that need less water irrigation	.01	.09

In addition, the dataset included four variables to control for socio-demographic differences. Age was measured as a continuous variable with responses from 18

to 80 years. Education represented five consecutive stages of schooling ranging from 1=”no formal education” to 5=”university degree or higher”. Gender (*Female*) entering as binary variable with 1=”female” and 0=”male” and income (1=”low”, 2=”medium”, 3=”high”) were accounted for as well. Descriptive statistics are shown in Table 4.2.

Table 4.2: Descriptive statistics

Variable	Mean	SD	Min.	Max.
Water conservation behavior	2.62	1.65	0	10
Abu Tawfeer	0.22	0.41	0	1
Age	38.75	13.52	18	80
Education	3.42	0.98	1	5
Female	0.42	0.49	0	1
Income	1.87	0.52	1	3
Scarcity	3.29	0.91	1	4
Responsibility	1.64	0.78	1	4
Actions	2.29	1.47	0	9

Note: Scarcity = Awareness of the water scarcity situation; Resposibility = Awareness of people’s responsibility for the present water situation and solutions to it; Actions = Awareness of household water conservation behaviors

4.3.3 Estimation strategy

In line with the study’s objective, a solid estimation framework was required to quantify the strength between the variables, while accounting for random noise as well as other pitfalls in the data. In this part, the models and the underlying estimation approaches are described.

While Kendall tau b correlation coefficients were used to measure the relationship between the variables, the main analysis was based on OLS multivariate regression techniques. First, OLS regression was used to estimate the degree to which the Abu Tawfeer campaign influenced people’s awareness, i.e. each of the three factors (see Table 4.3). Simultaneously, the four socio-demographic variables were included as control variables in the three models to account for any systematic differences between the persons. As the sample had been collected by the random route method, the data fulfilled the requirement of being independent and identically distributed. In order to ensure the correct specification of the OLS model, Huber-White standard errors were used to account for heteroscedasticity. However, the cross-sectional nature of the data

did not allow to rule out endogeneity between *Abu Tawfeer* and the respective awareness regressor a priori.

Thus, an instrumental variables approach was applied to test for reverse causality in the OLS regression results. The presence of endogeneity would mean that people with a higher level of awareness merely remembered the campaign better than others. A Wu-Hausman test was performed using two instruments, which were directly taken from the same questionnaire. One was the item "The government should enforce penalties on people who misuse water" and the other one was the mere number of household members. Both instruments were uncorrelated with the dependent variable and showed a significant overlap with *Abu Tawfeer*. In sum, this procedure ensured that the impact of the Abu Tawfeer campaign on the awareness variables was measured correctly.

Table 4.3: Multivariate regression results for the three awareness factors

Dependent variables:	**Scarcity**	**Responsibility**	**Actions**
F statistic	.56	4.52 **	5.36 **
Adjusted R^2	-.01	.07	.06
	β (stand.)	**β (stand.)**	**β (stand.)**
Abu Tawfeer	.06	.18 **	.10
Age	.00	.04	.02
Education	-.03	-.12 **	.04
Female	.05	.03	-.23 **
Income	-.00	-.11 *	-.09

*Note: N = 367; **p < .01, *p < .05; Huber-White standard err*

In order to examine the determinants of actual water conservation behavior, five different OLS regression models were estimated (see Table 4.4). The regressors in Model 1 were only composed of the four socio-demographic control variables. In Model 2, *Abu Tawfeer* was added to the list of regressors to assess its partial effect on water conservation behavior. Similarly, in Model 3 *Abu Tawfeer* was substituted by the three awareness factors. This distinction allowed for a separate measurement of the individual effects of the Abu Tawfeer campaign and the awareness factors. In order to avoid possible multicollinearity

problems, as some of the control variables were correlated with the awareness factors, in Model 4, the control variables were excluded from the regressors. Finally, a joint analysis of all regressors was performed in Model 5. For all models, robust standard errors were used to account for heteroscedasticity.

4.4 Results

The results of our analyses are presented in two parts. The first part describes the impact of the campaign on the three awareness factors (i.e. Hypotheses H1a - H1c). The second part contains the hierarchical regression analysis to determine the significance of the water conservation determinants and, especially, the partial effect of *Abu Tawfeer* (i.e. hypothesis H2).

4.4.1 Effect of Abu Tawfeer campaign on awareness factors

As a first step, a correlation analysis between Abu Tawfeer and the three awareness factors was conducted to test hypotheses H1a – H1c. The analysis yielded Kendall tau b correlation coefficients for *Abu Tawfeer* with *Actions* of r=.07 *(*p=.12), with *Scarcity* of r=.07 (p=.16), and with *Responsibility* of r=.14 (p<.01). Thus, the data showed that knowing the campaign is positively related to people's water conservation awareness, but only with respect to their feeling of responsibility for the water scarcity (see hypothesis H1b). In contrast, the data revealed that the campaign did not have a significant effect on people's awareness of how to conserve water in the household and awareness of the general scarcity situation, i.e. hypotheses H1a and H1c need to be rejected.

In order to support the correlation analysis results, the impact of the campaign on the three awareness factors was additionally evaluated by means of a regression analysis for each factor (see Table 4.3). Simultaneously controlling for age, gender, income, and education, a multivariate OLS regression model was tested. The analysis showed standardized regression coefficients for *Abu Tawfeer* with respect to *Scarcity* of b=.06 (p=.27) and *Actions* of b=.10 (p=.05). Whereas the impact of *Abu Tawfeer* on *Scarcity* turned out to be insignificant, its influence on *Actions* depends on the evaluation of significance. When applying a less strict significance level of α=10%, an effect of the Abu Tawfeer campaign on *Actions* could be claimed. When *Responsibility* was the dependent

variable, the coefficient of *Abu Tawfeer* was highly significant and had a value of b=.18 (p<.01). For this model, the share of explained variation was R^2=.07 and model fit turned out to be sufficient (F(5, 361)=5.58, p<.01). As the relationship between *Abu Tawfeer and Responsibility* might have been confounded by reverse causality, an instrumental variables approach was used again. Performing a Wu-Hausman test yielded a value of F(1,360)=.21 (p=.64). Thus, the null hypothesis cannot be rejected, i.e. the test showed that the original regression results for *Abu Tawfeer* were not confounded by endogeneity.

4.4.2 Effect of Abu Tawfeer campaign on water conservation behavior

After testing the effectiveness of the campaign on the three awareness variables, the actual behavioral outcomes were assessed. Water conservation behavior as the dependent variable was step-wised regressed upon the socio-demographic control variables, the three awareness factors, and *Abu Tawfeer*. With this hierarchical approach, the partial effects of the campaign could be singled out. Table 4.4 shows the regression results for the five different models.

Table 4.4: Multivariate regression results for water conservation behavior as dependent variable

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
F statistic	4.75 **	5.06 **	21.59 **	45.32 **	18.96 **
Adjusted R^2	.04	.06	.34	.33	.35
	β (stand.)	**β (stand.)**	**β (stand.)**	**β (stand.)**	**β (stand.)**
Age	.05	.07	.04		.05
Education	.01	.01	.01		.01
Female	-.19 **	-.21 **	-.09 *		-.10 *
Income	-.05	-.05	.02		.02
Abu Tawfeer		.15 *			.07
Scarcity			-.07	-.07	-.07
Responsibility			.19 **	.17 **	.18 **
Actions			.49 **	.51 **	.48 **

*Note: N = 367; **p < .01, *p < .05; Huber-White standard errors*

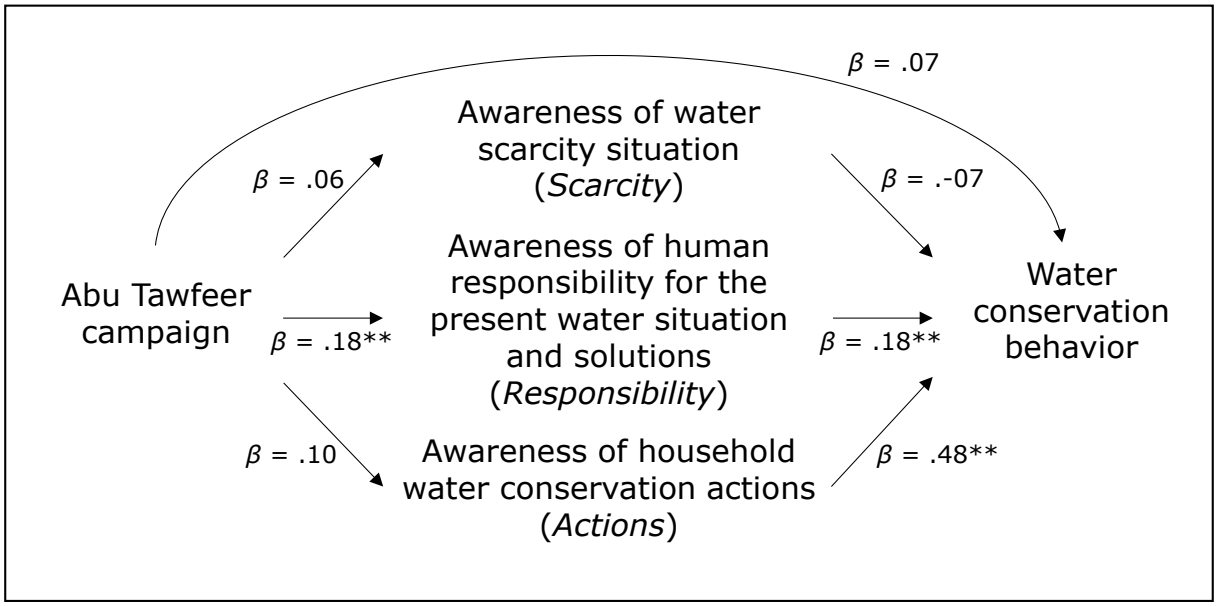
Model 1 only included the four socio-demographic variables. The share of explained variation was rather low (R^2=.04) and only *Female* turned out to have a significant effect on water conservation behavior. The negative sign indicated that women engaged less in water conservation than men. The respondents' age, level of education, and income did not have an influence on water conservation behavior.

Model 2 examined the direct behavioral effect of the Abu Tawfeer campaign. Controlling for socio-demographic differences, its coefficient was positive and statistically significant (b=.15, p<.05). Thus, water conservation behavior was affected by the campaign, even though the increase in explained variation for this model was marginal. A Wu-Hausman test for endogeneity yielded a value of $F(1,360)=2.20$ (p=.14), hence, the effect of *Abu Tawfeer* was not confounded by endogeneity.

In Model 3, the three awareness factors were substituted for *Abu Tawfeer* in the regression equation. This resulted in a substantial increase in explained variation of ΔR^2=.28. The control variables were insignificant except the gender dummy. Among the three awareness factors, *Responsibility* and *Actions* showed significant coefficients, whereas *Scarcity* did not have a significant impact on water conservation behavior. Thus, people's level of water conservation awareness was found to be fundamental for explaining differences in water conservation. Not surprisingly, the results showed that the greater the awareness of conservation actions, the more they were implemented and the more people attribute responsibility to individual consumers, the greater their own conservation efforts. The latter confirms an indirect effect of the Abu Tawfeer campaign on water conservation behavior (see hypothesis H2), as *Abu Tawfeer* was found to be a significant predictor of *Responsibility* (see Table 4.3). However, being aware of water scarcity in Jordan was not significantly related to water conservation behavior.

The results of model 4 confirm the stability of the regression estimates from Model 3. The socio-demographic control variables were excluded in order to rule out multicollinearity as the awareness factors and some control variables were correlated. The results showed that significance levels as well as estimated coefficients of the awareness factors remained stable. The R^2-value did not

change substantially indicating that the awareness indicators are in fact crucial drivers of water conservation behavior.



*Note: **p<.01; *p<.05; all coefficients are standardized; coefficient for Abu Tafeer campaign derived from the joint model (Table 4, Model 5); Huber-White standard errors*

Figure 4.2: Regression results for the conceptual model of the Abu Tawfeer campaign

Model 5 built upon the results of Model 2 and Model 3, which showed that both the Abu Tawfeer campaign and two of the three awareness factors had a significant impact on water conservation behavior individually. This model tested the joint effect of all regressors. In other words, it assessed, whether the campaign affected conservation behavior in any other way than through the awareness factor *Responsibility*. The joint model showed an explained variation of R^2=.35. Again, the coefficients for the awareness factors *Responsibility* and *Actions* were significant. However, the coefficient for *Abu Tawfeer* was not significant either (p=.16), i.e. the awareness factor *Responsibility* fully covered the campaign's effect on water conservation behavior (hypothesis H2). Figure 4.2 summarizes the key results of the impact evaluation of the Abu Tawfeer campaign.

4.5 Discussion

This study examined the long-run effects of a water conservation media campaign in Jordan. Featuring the comic figure Abu Tawfeer on various media channels, the campaign aimed to influence people's water conservation awareness and actual water conservation behavior. Using a cross-sectional dataset collected five years after the end of the campaign, our analysis revealed that the campaign had a partial effect on water conservation awareness and behavior. In particular, the campaign increased people's understanding that individuals are responsible for the present water scarcity situation and solutions to it. However, awareness of the severity of the scarcity situation and knowledge of particular household water conservation actions were not affected by the campaign. In addition, the data demonstrated the relative importance of water conservation awareness, as both factors *Responsibility* and *Actions* turned out to be significant behavioral determinants to result in an actual increase in water conservation commitment. A joint model (Model 5) revealed that the campaign's impact on water conservation behavior was fully entailed in the change of the awareness factor *Responsibility*.

These results pose various implications for policy makers and practitioners. This is the first attempt to provide scientific evidence for the effectiveness of the Abu Tawfeer campaign. So far, descriptive narratives were the only published reports stating that it was successful (USAID, 2010). What this impact evaluation in fact revealed was a more distinguished picture of the true effects of the campaign. Thus, this study emphasizes the need for systematic impact evaluation, if one is interested in the degree to which the campaign actually achieved its objectives of awareness raising and behavior change (OECD, 2014).

Moreover, the analysis confirmed the relative importance of psychological variables in changing people's conservation behavior in contrast to socio-demographic characteristics (e.g. Bamberg, 2003). The model, which only took socio-demographic characteristics as regressors, yielded a share of explained variation of R^2=.04. In contrast, when the regression equation only entailed the three awareness factors as regressors (Model 4), the share increased to R^2=.33. This result provides valuable information for future media and communication efforts, as our results demonstrate the substantial impact of awareness elements in attempts to increase people's conservation behavior.

Furthermore, this study provides empirical evidence for the long-run effectiveness of a water conservation media campaign, as recalling Abu Tawfeer was found to indirectly determine water conservation behavior (hypothesis H2). In detail, the effect was realized by a change in awareness (*Responsibility*). This finding stands in contrast to previous research, which could not measure a long-run behavioral conservation effect (e.g. Billings & Day, 1989). Being aware that we merely detected the existence of this effect, no concluding remarks can be made regarding the scale of the effect. An average value of M=.22 for *Abu Tawfeer* indicates that only less than a quarter of the respondents could remember the campaign's icon at all. This does not allow for any generalization on a national level. In sum, this paper provides robust scientific evidence for the true effect of the WEPIA campaign on water conservation awareness and behavior and revealed surprising results with respect to its original objectives.

Nevertheless, the following limitations of this research need to be mentioned. First, the cross-sectional nature of the dataset does not allow for a true causal analysis. Optimally, one would hope for an experimental design with a treatment and control group or, alternatively, a panel dataset. Nonetheless, the (instrumental variable) regression methodology applied here is an adequate approach to measure the relationship between such variables. Even though causality cannot be guaranteed, the results indicate the campaign's true effects. Second, measuring the independent variable by relying on people's memorization of the campaign figure had to imply that its key messages were also known. Despite this leap in assumption, the analyses yielded reliable results as they were based on a fundamental measurement framework.

Recommendations for future research include a replication of this study and, in particular, a more advanced investigation of the role of awareness in determining behavior change. Undoubtedly, more empirical evidence is needed to assess the various effects of media conservation campaigns with respect to water conservation and, in general, environmental conservation. To this end, this study provides valuable information for politicians, practitioners, and scholars working on a more sustainable resource use. The geographic focus on one of the most water scarce countries in the world adds to the relevance of the study.

5 Water Conservation Behavior under Scarcity Conditions: Exploring the Impact of Socio-demographic and Psychological Determinants in Jordan

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Abstract

The Hashemite Kingdom of Jordan is one of the most water scarce countries in the world. Increased groundwater depletion, changing lifestyles, and population growth exacerbate the pressure on the country's water resources. In order to implement effective policies to reduce water demand, knowledge about the relevant factors underlying urban household water conservation behavior are crucial. Thus, in this paper we utilize two distinct Jordanian datasets to examine various socio-demographic and psychological determinants of water conservation behavior. In sum, we find that environmental attitude explains a large share of conservation behavior, whereas age, income, and level of education do not have an influence. Hence, water conservation is not limited to specific societal groups. As a consequence, conservation campaigns and other policy efforts should be targeted at a rather broad audience. Our results are crucial for policy makers and development practitioners alike.

5.1 Introduction

Jordan is one of the most water scarce countries in the world (UNDP, 2013). Population growth, exacerbated by the recent influx of Syrian refugees, flourishing living standards, and economic development have led to a severe disproportion between available water resources and demand. The deficit was projected to reach 450 million cubic meters by 2025, a gap of approximately 25% of the estimated demand (Haddadin, 2011). Historically, approaches to satisfy the water needs of agriculture, households, and industry have focused on supply-side measures, such as an improved access to surface water (e.g. Jordan River, Yarmouk River), greater exploitation of groundwater reservoirs (including the Disi water conveyance project), and an enlarged capacity of wastewater treatment. While water supply is physically limited and future generations as well as ecosystems rely on sustainable abstraction rates, reduced water demand is a powerful and, at the same time, low cost option to reduce the gap in the water balance (Arlosoroff, 2006, p. 263).

Given the extreme water scarcity in Jordan, efforts to balance water needs and availability are paramount to secure long-term development, economic growth, and political stability. Jordan's national water strategy "Water for Life" (2008-2022) encompasses a clear focus on water demand management by directly promoting water use efficiency and water conservation (MWI, 2009). Though, translating the overall goal of reduced water demand into effective behavioral change measures requires increased efforts to reduce household level consumption and, as a prerequisite, detailed knowledge about the determinants of water conservation behavior.

Traditionally, water demand was regulated by adjustments in the water tariff. However, there is a growing consensus that the price of water only marginally influences residential consumption (Worthington & Hoffmann, 2008). Consequently, it becomes more and more important to understand the impact of socio-demographic and, especially, psychological factors on water conservation. Restraining one's own water consumption, similar to engaging in any other ecological behaviors, requires a high level of conviction or, in other words, a profound motivation to act modestly, pro-socially, or even altruistically. Such personal traits are commonly associated with two psychological constructs: first, the personality factor Honesty-Humility (Ashton & Lee, 2005)

and, second, environmental attitude, a latent disposition which determines a person's tendency to act ecologically. While both latent factors have been empirically related to pro-environmental behavior (HH: Hilbig et al., 2012; environmental attitude: Kaiser et al., 1999), few studies have investigated their impact on water conservation behavior. Previous research outside the Middle East and Northern Africa (MENA) region found a positive relationship between water conservation behavior and attitudinal constructs such as environmental beliefs (Corral-Verdugo et al., 2003), environmental consciousness (Mondéjar-Jiménez et al., 2011), and environmental concern (Wolters, 2014). In terms of socio-demographic factors, previous research showed mixed results for age, income, and education (for an overview, see Fielding, Russell, Spinks, & Mankad, 2012). Despite the growing body of literature examining the role of such variables in explaining water use behavior, to date, empirical studies from the MENA region are scarce.

In this paper, we aimed to address this research gap by providing a comprehensive account of water conservation determinants in Jordan. Based on two distinct datasets across various age, education, and income groups, we described the relationship of a broad range of socio-demographic and psychological factors with individual water conservation behavior and quantified their relative impact. Our results revealed critical, new insights for policy makers to respond to water scarcity in Jordan. In the following, we briefly discuss the literature on water conservation determinants, present two case studies, and conclude with a summary of the main findings, direct policy implications, and future research recommendations.

5.1.1 Socio-demographic determinants

Previous research highlighted the importance of socio-demographic variables in determining differences in people's conservation behavior. In terms of gender, several studies found that females generally engage more in pro-environmental activities than men (e.g. Blocker & Eckberg, 1989; Mohai, 1992; Stern, Kalof, Dietz, & Guagnano, 1995; Tindall, Davies, & Mauboules, 2003; Wolters, 2014). Yet, no study has examined gender differences with respect to water conservation behavior. Studies examining the impact of income on household water conservation showed ambiguous results. Empirical evidence for a positive

relationship exists for the purchase of water-efficient equipment (Renwick & Archibald, 1998; Lam, 2006) and for a set of 17 household conservation activities (Berk et al., 1993). On the contrary, several studies (e.g. De Oliver 1999; Gregory & Di Leo, 2003; Jeffrey & Gearey, 2006) reported that high income was negatively correlated with water conservation. For age, there is no clear evidence for a linear relationship. Rather, findings suggested that water conservation behavior varies with different life stages and associated needs and experiences. While teenagers seemed to care less about water conservation (Makki et al., 2012; Mayer & DeOreo, 1999), older people engaged more in water conservation behaviors (Clark & Finley, 2007; Gregory & Di Leo, 2003; Olli et al., 2001; Wolters, 2014). Mixed results were found for education, as a higher degree may lead to a better understanding of the scarcity problem. In turn, education may be confounded with income, as a higher education often leads to a higher income. Clark and Finley (2007) reported greater conservation engagement for people with higher education, whereas others found empirical evidence for the opposite (e.g. De Oliver, 1999; Gregory & Di Leo, 2003). Dolcinar et al. (2012) showed that university graduates applied significantly less water conservation measures than other people. Thus, empirical results, so far, do not show explicit relationships between water conservation and the main socio-demographic variables. In other words, further research is needed, especially under varying conditions, as most studies have been conducted in developed countries such as Australia, Mexico, France, Spain, or the US.

In addition to personal characteristics, water use behavior also varies with a person's particular housing situation. Past research identified the number of residents to be a relevant contextual factor to explain household water use (e.g. Aitken, Duncan, & McMahon, 1991; Aitken et al., 1994; Jeffrey & Gearey, 2006), though larger families were found to realize economies of scale by joint water use, and, thus, experienced comparatively lower per capita consumption (Hoglund, 1999; Randolph & Troy, 2008). Literature is scarce concerning the effect of the age of the dwelling on the resident's water use behavior. On the municipality level, Nauges and Thomas (2000) reported a positive relationship between total water consumption and the share of old houses. Conversely, Millock and Nauges (2010) found that the adoption of water-efficient household appliances was higher in newer houses. These ambivalent results exemplify the

contrary effects related to the age of a house. In general, more recently built dwellings are more likely to be equipped with water-efficient appliances, yet the increase in standards makes a retrofit for such houses less economical. Regarding home ownership, Grafton, Ward, To, and Kompas (2011) determined a negative, but not significant relationship between living in a detached/semidetached house and household water consumption. They also reported that persons living in single houses showed greater conservation engagement for three specific behaviors ("Turn Off the Water While Brushing Teeth", "Plug the Sink When Washing Dishes", "Water the Garden in the Coolest Part of the Day to Save Water), while lower efforts for another action ("Collect Rainwater/Recycle Waste Water").

Summarizing, previous studies demonstrated that individual water use behavior differs with personal and housing characteristics. But are these variables sufficient to explain differences in individual water conservation behavior? Fielding et al. (2010) provided a comprehensive regression analysis of the determinants of water end use controlling for the number of residents. Despite jointly including several socio-demographic, attitudinal, habitual, and conservation variables (e.g. existence of a dual-flush-toilet or a water-wise washing machine), the model only explained 43% of the variation in the dependent variable. Recognizing that environmental attitude accounts for at least 50% in ecological behavior variance (e.g. Kaiser et al., 1999), we proposed a closer examination of such latent psychological constructs as a significant predictor of water conservation behavior. In the following, we review the literature on psychological determinants of water conservation behavior.

5.1.2 Psychological determinants

Conservation psychology scholars have extensively studied the role of attitudes, concerns, and beliefs in explaining water conservation behavior. Several studies demonstrated that positive attitudes towards a specific water conservation behavior were associated with stronger intentions to perform that very action (e.g. Harland et al., 1999; Lam, 1999, 2006; Trumbo & O'Keefe, 2001). For instance, Clark & Finley (2007) empirically linked water conservation attitudes to curtailment and efficiency intentions, i.e. reducing one's own water consumption and using the resource in a more efficient way. Even though it may

seem trivial that a positive inclination towards an object results in respective behavioral responses, some studies could not establish a significant relationship between water conservation attitudes and behavior (e.g. Aitken et al., 1994; De Oliver, 1999; Gregory & Di Leo, 2003; Miller & Buys, 2008). In an attempt to explain such ambiguous findings, Russel and Fielding (2010) emphasized the importance of match of specificity of the attitude and behavior variable.

Beyond such specificity, researchers established a relationship of water conservation with other, more universal, concepts. For instance, Clark and Finley (2007) empirically linked general environmental beliefs to water conservation intentions. Another example was provided by Corral-Verdugo et al. (2008) who connected environmental beliefs to water conservation behaviors, while Mondejar-Jimenez et al. (2011) related water conservation behavior to a measure of environmental awareness. In addition, two studies reported that people who showed greater environmental concern or involvement in ecological activities engaged more in water conservation behaviors in their homes than others (Dolnicar et al., 2012; Willis et al., 2011).

Interestingly, environmental conservation could even be related to people's moral personality. Hilbig et al. (2012) investigated the role of the personality factor Honesty-Humility (HH) (e.g. Ashton & Lee, 2005; Ashton & Lee, 2007), which represents altruistic and prosocial tendencies (e.g. Lee & Ashton, 2012). In two separate studies, Hilbig and colleagues measured a statistically significant correlation coefficient of $r_{hh,eb}$=.41 between the HH factor and ecological behavior. Given that ecological behavior and water conservation are both associated with unselfish and pro-social orientations (e.g. Cialdini, 2003; Corral-Verdugo & Frias-Armenta, 2006; Kaiser & Byrka, 2011; Stern, 2000), we expected water conservation to be determined by Honesty-Humility.

5.1.3 Attitude-behavior framework

In the second case study, we explored the attitudinal dimension of water conservation. Measuring attitudes requires a solid conceptual framework, if standard measurement instruments are avoided, as it is the case here. Our conceptualization was based on the Campbell paradigm (cf. Campbell, 1963), which is grounded in the assumption that, when following a goal (e.g.

environmental protection), people usually choose from various alternatives to express their individual aspiration level. Differences in esteem for an attitudinal object become obvious in the level of engagement in increasingly demanding behaviors. Thus, we can expect a person with a high devotion for environmental protection to overcome great sacrifices to realize his or her goal (Kaiser et al., 2010). This may, for instance, include buying products in refillable packages or reusing shopping bags. On the contrary, a person's devotion to environmental protection must be rather low, if the smallest inconvenience is sufficient to prevent that person from engaging in such activities.

Performing a behavior also involves costs and sacrifices, which include monetary expenses, time, or personal effort (Kaiser & Wilson, 2004). Behavior-specific "difficulties" are generally the same for all persons in the same situational context, e.g. socio-cultural, geographic, or political conditions. For example, marking boxes in a survey to express environmental concern is commonly easier for everybody than installing solar-panels independent of the person's socio-cultural background, income, or housing situation. Assuming that people choose their activities prudently, i.e. they prefer a convenient behavior over a more demanding one (Kaiser et al., 2010), one can derive the contextual difficulty of each behavior from its engagement frequency in the sample. It follows that a rational person who engages in a particular behavior is also likely to practice less demanding activities directed at the same objective.

This framework was used to derive person values for water conservation attitude and environmental attitude. Technically, a one-dimensional model was analyzed in terms of item fit statistics and separation reliability.

5.1.4 Research objective

Following up on previous studies from the water demand management and conservation psychology literature (e.g. De Oliver, 1999; Fielding et al., 2010; Dolcinar et al., 2012) the overall objective of our research was to explore and quantify the impact of various socio-demographic and psychological water conservation determinants in Jordan.

Study 1 concentrated on the role of socio-demographic and housing characteristics in predicting water conservation behavior. As previous studies

found ambiguous results for the impact of age, income, and education (e.g. De Oliver, 1999; Gregory & Di Leo, 2003; Jeffrey & Gearey, 2006; Olli et al., 2001; Wolters, 2014) and gender has not been investigated at all with respect to water conservation, we did not post any hypotheses regarding the relationship between these variables and water conservation. Instead, we aimed to extend previous research and describe initial tendencies regarding the role of socio-demographic variables in explaining water conservation behavior. In that sense, we challenged the external validity of previous results.

In Study 2, we focused on the two psychological variables environmental attitude and the personality factor Honesty-Humility. Finding a significant positive impact for each variable would suggest that water conservation would likely to be rooted in a person's attitude or even personality. In other words, people would choose (not) to engage in water conservation based on a stable trait which, once acquired, is difficult to be changed (cf. attitude towards smoking) or even their personality, which was developed over many years.

5.2 Study 1

5.2.1 Participants and procedure

The dataset was collected as part of the Public Action for Water, Energy and Environment Project (PAP) administered by USAID in Jordan. The project started with a 5-year assessment and baseline phase, which ended in 2010 with a comprehensive national survey on people's behavior, opinion, and problem awareness regarding water conservation, energy saving, and household waste disposal (USAID, 2010). To ensure representativeness, participants were selected by the random route method, i.e. each respondent had the same chance of taking part in the survey. Each selected household was visited in person by an interviewer to ensure that only the person in charge of water, fuel, and household waste answered the questionnaire.

5.2.2 Measures

The dependent variable consisted of a composite of 16 water conservation behaviors in the household (see Table 5.1). Participants were asked to mark

those actions they currently engaged in (1="yes"; 0="no"). As the measure reflects the full range of conservation options, the sum score of all answers represents a person's average water conservation commitment. It is interesting to see, that habitual actions such as "using a bucket instead of a hose" or "taking shorter showers" were similarly (less) popular than investment decisions such as buying "water saving devices" or "water efficient plumbing products".

Table 5.1: Endorsement of 16 water conservation items

"What are you currently doing in order to save water?"	Mean	Std. Dev.
Using a bucket instead of a hose	.54	.50
Conducting regular maintenance on water pipes, tanks, fixtures, and/or toilet tanks	.53	.50
Using water saving devices	.38	.49
Fixing any leakage or broken pipes immediately	.24	.43
Closing the faucet water while teeth brushing/ dish washing	.19	.39
Washing vegetables in buckets instead of running water	.13	.34
Reusing gray water	.13	.33
Taking shorter showers	.13	.33
Owning an efficient automatic washing machine	.12	.33
Running full loads in washing machines / wash once a week	.08	.26
Placing a brick or a bottle in the toilet tank	.04	.20
Owning water efficient electrical appliances	.03	.17
Owning water efficient plumbing products	.03	.16
Having power spray attached to a hose	.02	.15
Collecting and using rain water	.01	.12
Planting plants that need less water irrigation	.01	.09

In line with the pertinent environmental conservation literature (e.g. Jones & Dunlap, 1992; Steel, 1996; Dunlap, Van Liere, Mertig, & Jones, 2000), the data set contained various socio-demographic variables to explain individual differences in water conservation behavior (see Table 5.2). Socio-demographic measures included age, education, gender, and income. Age represented the respondent's age at the time of the survey. Education accounted for the different schooling stages ranging from 1="no formal education" to 5-"university degree or higher". Gender entered as a binary variable (1="female") and income was represented by three broad categories: low, medium, and high. In addition, we employed three regressors related to the individual's living conditions and their home. We accounted for differences in the water bill, which entered the model as a categorical variable. It contained 8 different categories ranging from 0="0 JD" to 7="51-70 JD". There were no responses for bills above 70 JD. Moreover,

the number of household members and the age of the dwelling (in years) were included.

Table 5.2: Descriptive statistics

Variable	Mean	SD	Min.	Max.
Water conservation	2.62	1.65	0	10
Female	0.42	0.49	0	1
Income	1.87	0.52	1	3
Age	38.75	13.52	18	80
Education	3.42	0.98	1	5
Water bill (3 months)	3.26	1.59	0	7
Number of inhabitants	5.77	2.56	1	17
Age of dwelling	20.93	13.37	0	70

5.2.3 Estimation methodology

As we aimed to investigate the significance and marginal effects of the determinants, we employed an ordinary-least squares model. The heterogeneigty in regressors required robust standard errors. Using standardized coefficients enabled us to compare the relative influence of each regressor. By consecutively adding the socio-demographic and housing regressors in groups, we obtained the relative shares of variance explained for these categories. A joint model was performed to derive the overall effect of all determinants (Model 3). In addition, a cluster analysis assessed differences in water conservation behavior between homogenous groups within society.

5.2.4 Results

Regression analysis

Table 5.3 shows the whole regression analysis output for the three models. Even though each model yielded a statistically significant F-value, explained variance remained rather low. Nonetheless, our findings are in line with previous research on environmental conservation behaviors, which expects socio-demographic variables to explain about ten percent of variation in the dependent variable (e.g. Bamberg, 2003; Olli et al., 2001; Wall, 1995).

Model 1 constituted the base model. It included gender (0=male, 1=female), income, age, and education as regressors of water conservation. Similar to Wolters (2014) and Olli et al. (2001), a significant relationship for gender could be established, yet a negative one. The coefficients for the other variables were not statistically significant. In other words, water conservation did not have an asserted relationship with a person's income, age, or level of education. A correlation analysis showed that only income and education were linearly related (r=.14). All other bivariate relationships were not significant. These findings confirm the ambiguous results of former studies (see section 5.1.1), which reported either a positive, a negative, or no relationship at all.

Table 5.3: OLS regression results of water conservation behavior

	Model 1	**Model 2**	**Model 3**
F statistic	3.66**	9.80**	5.97**
Adjusted R^2	.03	.07	.09
	β (stand.)	**β (stand.)**	**β (stand.)**
Age	.05		.04
Education	.01		.04
Female	-.19**		-.16**
Income	-.05		.02
Age of dwelling		.27**	.26**
Number of inhabitants		.00	-.01
Water bill		-.05	-.07

*Note: n=367; **p<.01, *p<.05*

Model 2 examined the relationship between water conservation and the amount of money a household spends on water within three months (*water bill*), the *number of inhabitants*, and *age of dwelling*. Our results corroborated that a higher water bill indicates that inhabitants show lower levels of conservation effort. Note that we simultaneously controlled for the number of household members. In contrast to the common view that larger households can achieve economies of scale, we did not find a significant impact of household size on water conservation. Moreover, people living in older houses engaged more in water conservation. Not surprisingly, water bill and number of inhabitants were slightly correlated (r=.14). Model 3 tested the joint impact of all determinants

on water conservation. It showed no noteworthy differences to the other two models.

In sum, our results indicated three significant predictors of water conservation behavior, namely gender, the size of the water bill, and the age of the house or apartment. In turn, the data revealed that a person's age, income, and level of education does not affect water conservation commitment. In comparative terms, the variables with the highest standardized coefficients in absolute values are the ones, which turned out to be significant determinants. Yet, none had a value higher than b=.2.

Cluster analysis

The regression analysis suggested that socio-demographic variables do not substantially influence water conservation behavior. However, it is possible that there are differences between societal groups, which are homogenous in terms of age, education, gender, and income. Thus, we additionally conducted a cluster analysis to test for such socio-demographic group differences with regard to water conservation behavior. After standardizing the four variables, the hierarchical method of single linkage clustering was used to identify outliers, which would not be able to integrate into any other cluster. As this test did not reveal any outliers, we then performed Ward's minimum variance method (e.g. Bacher et al., 2010; Backhaus et al., 2006) to detect compact groups of persons with similar characteristics. Table 5.4 shows the socio-demographic profile of each cluster and its average water conservation performance.

Cluster 1 only contains male persons, while it does not differ notably in terms of age, education, and income from the whole sample. Similarly, Cluster 2 represents average females. Interestingly, Cluster 3 stands out, as the persons are much older on average, far less educated, and almost all fall into the lowest income class. At first glance, no cluster deviated much from the sample mean in terms of water conservation performance. Investigating the differences in more detail by conducting a t-test for mean comparisons revealed that Cluster 1 engaged significantly more in water conservation than Cluster 2 (t=2.65, df=335, α=.05). Yet, this can be explained by the strict gender separation of these clusters. As the regression analysis found a negative significant coefficient

for *female*, this result directly reflects the lower level of water conservation among women. Moreover, the analysis showed no systematic difference between Cluster 3 and the rest of the sample in terms of water conservation. This result is particularly striking, since Cluster 3 represents a distinct societal class, namely the low-income, poorly educated ones. Despite the high proportion of females in that cluster, mean water conservation was above the sample average.

Table 5.4: Socio-demographic characteristics of clusters

Variable	Sample	Cluster 1	Cluster 2	Cluster 3
Cluster label		Average male	Average female	Underpriviledged
Number of persons	367	205	132	30
Water conservation (mean)	2.62	2.89	2.17	2.73
Age (mean)	39	38	37	53
Female	42%	0%	100%	70%
Education	1: 3%	1: 1%	1: 0%	1: 27%
	2: 12%	2: 9%	2: 3%	2: 73%
	2: 43%	3: 43%	3: 52%	3: 0%
	2: 26%	4: 29%	4: 28%	4: 0%
	2: 16%	5: 18%	5: 17%	5: 0%
Income	Low: 21%	Low: 14%	Low: 14%	Low: 93%
	Medium: 71%	Medium: 77%	Medium: 78%	Medium: 7%
	High: 8%	High: 9%	High: 8%	High: 0%

Note: Education categories include 1="no formal education", 2="completed elementary education", 3="completed secondary education", 4="completed complementary education", 5="university degree or higher"

5.3 Study 2

5.3.1 Introduction

In Study 2, the focus shifted from socio-demographic and housing variables to psychological characteristics. It was mainly motivated by the low share of explained variation in Study 1 (adjusted R^2=.03). Even though this result was largely in line with previous studies (e.g. Bamberg, 2003), it indicates that other variables may play a greater role in explaining differences in water conservation behavior between people. Thus, drawing from the environmental psychology literature, we examined the impact of personal attitudes (e.g. Kaiser et al., 1999) and a person's altruistic or pro-social nature (e.g. Hilbig et al., 2012) here. Studies, so far, have only tested the effect of these variables on general ecological behavior. However, this study was the first one to examine their

impact on water conservation behavior. Besides this novelty, we replicated the findings from Study 1 for the two variables *gender* and *number of people in the household* and added two more variables that are relevant for the MENA region, namely faith (i.e. considering oneself a Muslim) and living in a single house. Given the urban structure of Amman, the latter serves as a proxy for wealth, as generally only well-off people can afford a single house. In sum, we proposed the following hypotheses: First, as a replication of Study 1, we suspected socio-demographic variables to only marginally affect household water conservation; second, we expected psychological determinants to have a significant impact and explain a major share of variation in water conservation behavior.

5.3.2 Participants and procedure

We collected the data by means of a survey among undergraduate students at the University of Jordan, Amman, in spring 2013. To ensure sufficient variability in the data, participants were randomly selected from four different faculties (medicine, business, foreign language, and agriculture) and from more than two different classes per faculty. Before distributed, the questionnaire was translated into Arabic by two professional academics including a back-translation into English (original version). The students filled out the questionnaire in class in less than 30 minutes. The survey was completely anonymous in order to prevent any social desirability bias.

5.3.3 Measures

The dependent variable was composed of a composite of 21 activities which all represent means of water conservation in the household. Among them, twelve more frequent behaviors were examined in a polytomous response format with answer choices ranging from 1=”never” to 5=”very often”. Those responses were recoded to a binary format by regarding 4=”often” and 5=”very often” as confirmations and 1=”never”, 2=”rarely”, and 3=”occasionally” as rejections. The other nine behaviors were framed in a yes/no format. In all cases, respondents could choose “not applicable” to allow for unsuitable items, which were treated as rejections. As a measure of internal consistency using Cronbach’s alpha, the water conservation scale yielded a value of α=0.80.

In addition, we calibrated the 21 behavior items on a Rasch scale (Bond & Fox, 2007). The separation reliability was r_{wc}=.68, i.e. respondents could sufficiently be distinguished based on their performance of water conservation behaviors. As a measure of model fit, we relied on the average mean square fit statistic, which was $M(MS_{items})$=.99 with a standard deviation of $SD(MS_{items})$=.16. Thus, the model predicted item performance quite well, as a perfect outcome would be $M(MS_{items})$=1.00 (Bond & Fox, 2007). Moreover, all but one of the items fit the acceptable range of .80 – 1.20 for MS values (Wright & Linacre, 1994), i.e. only one item predicted more than 20% variation in the data.

The questionnaire contained a measure of environmental attitude, which was composed of 41 behaviors of the GEB scale. It reflects behavioral commitment in various conservation domains such as energy saving, transportation, and recycling (Kaiser & Wilson, 2004). 27 more frequent behaviors were measured in a 5-point polytomous response format, which were recoded into a binary format for the analysis. The other 14 items were assessed in a yes/no format and "not applicable" answers were treated as rejections. Again, we tested for internal consistency using Cronbach's alpha. As the original 41-item scale yielded a relatively low value of α=.48, through an iterative process of item elimination we reached a value of α=.65 for an 18-item scale. Calibrating the 18 items on a Rasch scale showed a separation reliability of r_{env}=.65.

We furthermore assessed a measure of the Honesty-Humility personality factor which includes the four facets sincerity, fairness, greed avoidance, and modesty. Persons with a higher value of Honesty-Humility are generally assumed to possess greater prosocial and altruistic dispositions (Ashton & Lee, 2005). Due to limited space on the questionnaire, we used the short form of the Honesty-Humility inventory, which highly correlates with the original version (Lee & Ashton, 2004; Lee & Ashton, 2006). In addition, Chapter 3 entails such comparison for the German dataset. For more information on the inventory, the scales, and all items, visit hexaco.org. Participants were faced with a 5-point answer format ranging from 1="strongly disagree" to "5=strongly agree". Answers for items such as "I would get a lot of pleasure from owning expensive luxury goods" were reversed, e.g. "2=disagree" became "4=agree".

Additionally, the regression analysis included four variables to account for personal and housing characteristics. *Female* represented the gender of the

respondent (69% of the sample were females) and *Muslim* showed the respondent's religious affiliation (63%) with 1="Muslim" and 0="non-Muslim". We considered this variable, as the Qur'an explicitly demands sustainable use of water (Gallant, 2009). Hence, we expected people who considered themselves as Muslims to show a higher commitment to water conservation than non-Muslims. *Single house* accounted for the type of dwelling (43%) and *Household size* controlled for the number of people living in the same apartment. Table 5.5 shows descriptive statistics for all variables.

Table 5.5: Descriptive statistics

Variable	Mean	Std. Dev.	Min.	Max.
Water conservation	6.27	3.69	0	21
Female	0.69	0.46	0	1
Number of people in the household	6.05	1.89	1	9
Muslim	0.63	0.48	0	1
Single house	0.43	0.49	0	1
Honesty-Humility	2.45	0.45	0	3.90
Environmental attitude	-0.90	1.12	-3.69	2.55

5.3.4 Attitude measurement framework

As outlined above, Study 2 contained a detailed analysis of the attitudinal dimension behind water conservation in Jordan based on the Campbell paradigm (Campbell, 1963; Kaiser et al., 2010). An operationalization of this conceptual framework is described here. Given the objective to derive person values on an attitudinal object (e.g. environmental attitude) from behavioral observations, we applied the so-called Rasch model (see Bond & Fox, 2007). It formally describes the relationship between a person's attitudinal disposition and a behavior's situational difficulty by the following representation:

$$\ln\left(\frac{p_{ki}}{1-p_{ki}}\right) = \theta_k - \delta_i$$

The natural logarithm of the ratio of person *k's* probability of engagement (p_{ik}) and nonengagement in behavior *i* $(1 - p_{ik})$ is given by the difference between *k's* level of environmental engagement (θ_k) and the difficulty of behavior *i* (δ_i). In this mathematical representation, people are distinguishable based on their

degree of aspiration towards an environmental goal, and behaviors differ with respect to their "engagement costs". For each person, the specific transitive order of behavioral engagement probabilities constitutes the degree of environmental attitude (cf. DeFleur & Westie, 1963). Note that well-known technical problems that can occur with factor analytical approaches when behaviors are involved can be overcome by applying the Rasch model (Kaiser & Byrka, 2011). In our case, we applied the Rasch model to derive values for water conservation attitude and environmental attitude as well as investigated, whether both constructs were located on one and the same attitudinal dimension.

5.3.5 Results

In this study, we conducted two different analyses to better understand water conservation behavior in Jordan. First, we ran a hierarchical multivariate OLS regression analysis to test the impact of different socio-demographic and psychological variables on water conservation behavior. Second, we explored, whether a latent disposition (i.e. environmental attitude) could constitute the attitudinal basis of water conservation behavior.

Determinants of water conservation behavior

In order to assess the impact of various socio-demographic and housing characteristics on water conservation behavior, we performed a multivariate OLS regression analysis (see Table 5.6). Model 1 included gender, faith, number of people in the household, and a dummy variable for living in a single house or multi-party apartment. Explained variation was rather low (R^2=.01). Again, as reported in Study 1 and shown by previous other studies (e.g. Bamberg, 2003; Olli et al., 2001; Wall, 1995), socio-demographic and housing characteristics contribute little to explaining variation in conservation behavior. In addition, gender turned out to be the only significant determinant, which was also in line with the findings from Study 1. However, determining a non-significant relationship between household size and conservation engagement stands in contrast to the findings of Martínez-Espiñeira, García-Valiñas, and Nauges (2014).

Next, we tested the linear relationship of each of the psychological variables with water conservation behavior, respectively. Given the common-pool resource character of water in Jordan, we assumed that people with stronger moral dispositions showed higher c2onservation efforts. In fact, despite finding a positive effect, Model 2 indicated that Honesty-Humility was not a significant predictor of water conservation behavior. Thus, we cannot confirm the close link between people's moral personality and conservation engagement reported by Hilbig et al. (2012) or for a German student sample, as described in Chapter 3.

In Model 3, Honesty-Humility was substituted by environmental attitude as the only explanatory variable. The size of the standardized coefficient (b=.59) and the large share of explained variation (R^2=.35) indicate that environmental attitude is a substantial predictor of water conservation behavior. In line with Kaiser et al. (1999), we affirm the importance of environmental attitude in explaining conservation behavior.

Table 5.6: OLS regression results of water conservation behavior

	Model 1	**Model 2**	**Model 3**	**Model 4**
F statistic	3.00**	.16	394.70**	47.57**
Adjusted R^2	.01	.00	.35	.30
	β (stand.)	**β (stand.)**	**β (stand.)**	**β (stand.)**
Female	-.12**			-.07*
Number of inhabitants	.03			.05
Muslim	.06			.02
Single house	.02			.04
Honesty-Humility		.02		.03
Environmental attitude			.59**	.54**

*Note: n=725; **p<.01, *p<.05*

In order to assess the robustness of the results, Model 4 contained all of the six explanatory variables. Even though the size of the coefficients was marginally different, no coefficient changed its sign or significance. Hence, our data showed that water conservation is determined by people's gender and level of environmental attitude, whereas the latter accounts for up to 30% of variation in conservation behavior. Following up on this result, the next section

investigated the relationship between environmental attitude and water conservation in more detail.

The attitudinal basis of water conservation behavior

The regression analysis revealed that environmental attitude is a strong predictor of water conservation behavior. Yet, without further investigation we cannot conclude that environmental attitude is the prime attitudinal base for engagement in water conservation. So far, we assumed that water conservation behavior is directly affected by a person's attitude towards the very same subject, i.e. water conservation attitude. But what, if water conservation attitude is conceptually entailed in environmental attitude – a more comprehensive latent construct, which represents pro-social, altruistic, and moral tendencies? In order to answer this question, we first determined the correlation between both attitudinal constructs to quantify their conceptual overlap. Our analysis showed a correlation coefficient of ρ=.51 or ρ_{corr}=.77 when corrected for measurement error attenuation.

In a second step, we tested, whether all items from both scales can be calibrated on a single dimension. Acceptable fit statistics would provide further empirical evidence that water conservation behavior does not occur instantaneously, but is based on a stable latent trait, namely environmental attitude. Applying the Rasch model for all 39 items from both attitude scales yielded a separation reliability of r=.80. For the single scales values of r_{wc}=.68 and r_{env}=.65 were derived. Even though a greater number of items unequivocally expands the reliability statistic, the difference between the joint and the single statistics was notably. Hence, it is reasonable to assume that the joint model is better suited to distinguish persons based on their performance than the individual models. Additionally, for the one-dimensional model average item mean square was $M(MS_{items})$=.99 and the corresponding standard deviation was $SD(MS_{items})$=.12. Of the 39 items, only three exceeded the acceptable range of .80 – 1.20 for mean square values (see Table 5.7). Thus, this model described the data quite accurately with only little noise. Even though these results did not ultimately confirm that water conservation attitude is fully congruent with environmental attitude, we could yet conclude that both concepts are closely linked and that environmental attitude strongly determines water conservation behavior.

Table 5.7: 21 water conservation attitude items and 18 environmental attitude items

		δ_{one}	MS_{one}
	Water Conservation Attitude		
1	I shower for more than 3 minutes.*	2.48	1.08
2	I rinse vegetables under running water.*	1.30	1.13
3	I rinse the dishes under running water.*	1.03	1.19
4	I reuse greywater, e.g. for irrigating plants or cleaning the floor.	0.55	1.03
5	I reuse rainwater, e.g. for irrigating plants or cleaning the floor.	0.32	1.05
6	I prefer to shower rather than to take a bath.	0.31	1.15
7	I have bought or informed myself about a certified water-efficient dishwasher.	0.28	0.87
8	I have bought or informed myself about flow regulators.	0.22	0.78
9	I fill the dishwasher completely before usage.	0.20	1.09
10	I have bought water-efficient plants for my room or garden.	0.04	0.80
11	I have bought or informed myself about a certified water-efficient washing machine.	-0.26	0.79
12	I have bought or informed myself about faucet aerators.	-0.35	0.82
13	I use the water saving button of my dual flush toilet.	-0.38	1.13
14	I conduct periodical maintenance to the water network installation in my house.	-0.83	0.84
15	I water the garden early morning or after the sunset.	-0.86	0.82
16	I turn off the water while brushing teeth or soaping up in the shower.	-0.91	1.11
17	I conduct periodical maintenance to the ground and upper tanks.	-0.98	0.83
18	I fix leaks immediately (myself or with professional help).	-1.05	1.06
19	At home we have water-efficient showerheads installed.	-1.11	0.95
20	I fill the washing machine completely before usage.	-1.22	1.23
21	I check for leakages at home (e.g. toilet, faucets, showerhead).	-1.56	1.03
	Environmental Attitude		
22	I collect and recycle used paper.	1.67	1.00
23	I buy drinks in returnable bottles.	1.63	1.01
24	I bring empty single-use bottles to a recycling bin.	1.40	0.97
25	I talk with friends about problems related to the environment.	1.29	0.95
26	I am a member of an environmental organization.	1.28	0.94
27	I refrain from owning a car.	1.22	0.96
28	I boycott companies with an unecological background.	1.03	1.04
29	I read about environmental issues.	0.95	0.94
30	I buy products in refillable packages.	0.65	1.08
31	I buy meat, vegetables, and fruits with eco-labels.	0.22	1.06
32	I am a member of a carpool.	-0.10	1.01
33	I point out unecological behavior to others.	-0.17	0.96
34	I contribute financially to environmental organizations.	-0.17	0.96
35	I drive in such a way as to keep my fuel consumption as low as possible.	-0.31	0.91
36	I have a solar water heater on my roof.	-1.15	1.12
37	I own energy efficient household devices.	-1.28	0.92
38	I buy seasonal fruits and vegetables.	-2.51	1.07
39	After a picnic, I leave the place as clean as it was originally.	-2.85	1.05

Note: δ indicates the difficulty of an item expressed in logits; the more negative a logit value, the easier the particular behavior is and vice versa. Logits represent the natural logarithm of the item engagement/nonengagement ratio. *MS* represents item fit as a mean square (MS) value. The subscript *one* indicates findings from the one-dimensional calibration of the items.

5.4 General discussion

Using original data from two surveys, we assessed the relative impact of diverse socio-demographic and psychological variables on water conservation behavior in Jordan. Our results emphasize the relevance of environmental attitude in explaining differences in ecological behavior such as water conservation (cf. Kaiser & Gutscher, 2003; Kaiser et al., 2005). In accordance with previous studies (e.g. Bamberg, 2003), the data showed that the role of socio-demographic and housing characteristics in explaining conservation behavior is limited. Instead, environmental attitude explained three times more variation than all other variables combined (see Table 5.3 and Table 5.6). Besides general environmental commitment, other variables were also found to have a strong impact on water conservation behavior. For instance, being male, having a smaller water bill, and living in an older house or apartment indicated enhanced water conservation commitment.

This study poses several research and practice-oriented contributions in the field of water conservation and water management in the MENA region. First, adding to studies from other countries (e.g. Keshavarzi, Sharifzadeh, Haghighi, Amin, Keshtkar, & Bamdad, 2006; Morowatisharifabad, Momayyezi, & Ghaneian, 2012; Rosenberg, Talozi, & Lund, 2008) our data revealed a detailed look at individual conservation behaviors and their popularity among people living in Jordan. Moreover, yielding acceptable reliability and fit statistics when calibrating the behavioral water conservation items on a Rasch scale suggests that people's actions are actually based on an underlying trait, i.e. water conservation attitude. Thus, people may differ in terms of choice of individual behaviors, yet, their overall commitment remains rather stable and does not change ad-hoc.

Second, finding no significant relationship between a person's degree of water conservation and socio-demographic variables such as age, education, and income affirms the claim that conservation matters for all societal groups. This can be seen in particular, when looking at Cluster 3 (Table 5.4), which was composed of older, poorly educated, low-income people. A t-test did not find a significant difference to the sample mean and the other two clusters. Hence, it is worthwhile to address the whole population, when implementing conservation interventions.

Third, the importance of environmental attitude, as a major latent trait behind water conservation behavior suggests that educational efforts should focus on environmental protection. In that respect, young people, e.g. pupils and students, deserve special attention, as they are often still in the process of developing opinions, beliefs, and attitudes. Achieving a high level of environmental attitude among them can have long-term beneficial consequences for all ecological aspects including energy saving, recycling, or transportation modes. Even though Jordan has been systematically integrating environmental education in the curriculum of high school students since 1996, there is still a gap between students' perception of the local water situation and reality (Jaber & Grieser, 2005).

Future studies could build upon our research in the following ways. The cross-sectional data used here only revealed information about the importance of selected variables for explaining water conservation behavior. An actual impact evaluation of conservation interventions is needed to identify actual behavioral changes. Furthermore, investigating the effect of environmental attitude on actual water demand would contribute greatly to the discussion. In addition, future studies could test the impact of environmental attitude in a different setting to affirm its importance for predicting water conservation behavior. Nevertheless, our results provide valuable information, which are highly relevant for practitioners and politicians in Jordan and the MENA region.

6 Synthesis and Policy Implications

Understanding water conservation behavior is a crucial requirement for wise and efficient water demand management. When water is scarce, policy makers need to know, how to shape people's behavior in order to reduce demand. Numerous external and personal factors determine, whether or to which extent a person engages in water conservation. Against this background, this dissertation aimed to provide a comprehensive overview of the effects of different socio-demographic and psychological variables on individual water conservation behavior. The analysis covered two regions, which differ greatly in terms of geographic and living conditions. Germany is characterized by water abundance, relatively low prices, and high incomes. In contrast, Jordan suffers from extreme water scarcity and major parts of the population struggle to make ends meet. The analysis is structured in the form of four papers, which provide a comprehensive account of the determinants of water conservation.

The analyses revealed that water conservation behavior does not occur ad-hoc and change spontaneously from one day to another. Rather it is based on a latent trait, which is called water conservation attitude. This underlying disposition is realized by different behavioral means, which may vary from person to person. Hence, people with the same level of water conservation attitude might not choose the same individual actions as long as the overall commitment becomes apparent. Furthermore, water conservation attitude conceptually overlaps with a more comprehensive construct, namely environmental attitude, which represents cooperative and prosocial tendencies (e.g. Kaiser, & Byrka, 2011). This has some crucial policy implications. When general environmental protection is the objective, addressing people's environmental attitude can have multiple effects including enhanced water conservation. In other words, it may be efficient to address several ecological problems in a joint campaign instead of implementing efforts for each issue, e.g. energy conservation, water conservation, recycling. This can be particularly relevant in times of scarce public financial resources.

Water conservation in Germany can be considered a moral behavior, as saving water basically does not yield any benefits, not for the individual, for society, nor nature. The combination of water abundance and relatively low tariffs

(compared to average incomes) implies that material or external incentives do not play a role. Instead, morality is likely to guide people's behavior, i.e. the understanding of what is right or wrong independent of any cost or benefits (e.g. Thøgersen, 1996). In Chapter 3, we compared two psychological constructs, environmental attitude and the personality factor Honesty-Humility, regarding their potential to predict moral behavior. Even though both predictors are significantly related to moral behavior, environmental attitude explains a much greater share of variation. This suggests that the concept of environmental attitude strongly represents moral dispositions beyond cooperative and prosocial tendencies. An interesting theoretical aspect is that Honesty-Humility, which is an established measure of cooperative, prosocial, and moderate dispositions, seems to represent moral tendencies less than environmental attitude.

More practical implications are drawn from the results of the Jordanian studies. There, the aim was to identify significant predictors of water conservation behavior in order to derive concrete and tangible policy recommendations. Chapter 4 described an impact evaluation of the Abu Tawfeer water conservation awareness campaign. The data showed that five years after the end of the campaign, 22% of the representative sample could remember it. Yet, the campaign only had an effect on one out of three awareness dimensions, which is that people are aware that humans are responsible for the water scarcity as well as future solutions (and not e.g. the government or ministry). In turn, it equally revealed that the campaign did not increase people's awareness of the overall scarcity level and knowledge about behavioral options to save water. Whereas people are generally well informed about the water situation, it is fair to assume that the campaign was just not successful in increasing knowledge of water conservation options. These information are highly relevant for future water conservation campaigns, as they shed light on detailed aspects of the campaign. Nevertheless, water managers are advised to generally focus on raising awareness of individual responsibility and water conservation options, as those two dimensions make a difference in actual behavior. Additionally, the severity of the water situation does not need to be stressed in regions, which persistently suffer from water scarcity.

Regarding determinants of water conservation behavior, the data showed that people's age, level of education, and income do not matter. This result affirmed the claim that all parts of society are susceptible to water conservation. Of course, more well-off people are likely to have a greater volumetric potential to save water than less privileged people. But focusing only on the number of actions taken, those socio-demographic characteristics do not explain individual conservation differences. Consequently, these characteristics should not be used to single out particular target groups for behavioral change campaigns. Moreover, people with a higher environmental attitude significantly engage more in water conservation than others. As a once established attitude is difficult to change, systematic educational campaigns among the youth may be the basis for a new generation of people, who better take care of this precious resource.

There is no doubt that climate change, population growth, and increasing living standards will massively shape supply and demand of water in the upcoming decades. It is crucial for policy makers and water managers to understand the determinants of water conservation behavior as a powerful tool to lower demand. Even though agriculture and industry are the main water consumers, households can in fact contribute to reducing the pressure on water resources. However, as long as water scarcity is perceived as a technical problem, infrastructure projects may prevail as the chosen solution. Yet, in the long-run people will understand that water demand cannot grow endlessly and that water conservation becomes inevitable.

Appendix

1 Original questionnaire used for data collection in Germany

Kim Zietlow, Humboldt-University of Berlin

Survey on environmental attitude and behavior

Mr. Kim Zietlow, M.Sc. – Humboldt University of Berlin, Germany
Prof. Florian Kaiser, PhD – Otto-von-Guericke-University Magdeburg, Germany

THANK YOU for your time and commitment! Your participation is highly appreciated!

Step 1: Please read carefully the key information about this study

- This study is part of a **PhD project by Mr. Kim Zietlow**. The purpose is **scientific only**.
- Your data will be treated **highly confidentially**.
- You have **25 minutes** to fill out the questionnaire. Please answer **spontaneously without much deliberation**.
- Please proceed **step by step** through the different sections.

Step 2: Please read how to fill out the questionnaire

- There is **no right or wrong** answer. We would only like to know your point of view.
- Please choose **only one answer** for each question.
- Please answer **all questions**. If you are not able to answer a specific question (for example, if you don't have access to a car, you cannot answer the following statement: "I drive my car in or into the city."), mark the field **"NA" (not applicable).**

Step 3: Please create your unique personal ID

- Please create a unique ID. **The code will be unique and you are the only one who knows it.** At the same time, it is distorted enough not to disclose private information. The example shows you how to do it.

	0 1 2 3 4 5 6 7 8 9		0 1 2 3 4 5 6 7 8 9
Your birthday – Day:** (e.g. October 7 = **07**) - **EXAMPLE	x		x
Your birthday – Day: (e.g. September 2 = **02**)			
Your birthday – Year: (e.g. (1987 = **87**)			
Number of characters of your first name: (e.g. Kim = **03**)			
Number of characters of your last name: (e.g. Zietlow = **07**)			

If you have any questions, please contact **Mr. Kim Zietlow** (*Email: kim.zietlow@hu-berlin.de).*

1

Section 1: ***For the following behaviors, please indicate how often you perform them.*** *Choose NA (not applicable) if you are unable to give an answer.*

	Never	Rarely	Occa-sionally	Often	Very often	NA
I ride a bicycle or take public transportation to work or school.	☐	☐	☐	☐	☐	☐
I fill the dishwasher completely before usage.	☐	☐	☐	☐	☐	☐
I buy meat and produce with eco-labels.	☐	☐	☐	☐	☐	☐
I buy beverages in cans.	☐	☐	☐	☐	☐	☐
I fill the washing machine completely before usage.	☐	☐	☐	☐	☐	☐
I shower for more than 3 minutes.	☐	☐	☐	☐	☐	☐
I use an oven cleaning spray to clean my oven.	☐	☐	☐	☐	☐	☐
I buy domestically grown wooden furniture.	☐	☐	☐	☐	☐	☐
I rinse the dishes under running water.	☐	☐	☐	☐	☐	☐
I drive my car in or into the city.	☐	☐	☐	☐	☐	☐
In the winter, I leave the windows open for long periods of time to let in fresh air.	☐	☐	☐	☐	☐	☐
I rinse vegetables under running water.	☐	☐	☐	☐	☐	☐
I wash dirty clothes without prewashing.	☐	☐	☐	☐	☐	☐
I drive on freeways at speeds under 100km/h (= 62.5 mph).	☐	☐	☐	☐	☐	☐
For longer journeys (more than 6 hours), I take an airplane.	☐	☐	☐	☐	☐	☐
I turn off the water while brushing teeth or soaping up in the shower.	☐	☐	☐	☐	☐	☐
I prefer to shower rather than to take a bath.	☐	☐	☐	☐	☐	☐
I reuse wastewater, e.g. for irrigating plants or cleaning the floor.	☐	☐	☐	☐	☐	☐
If I am offered a plastic bag in a store, I take it.	☐	☐	☐	☐	☐	☐
In nearby areas up to 30 kilometers (=20 miles), I use public transportation or ride a bike.	☐	☐	☐	☐	☐	☐
I collect and recycle used paper.	☐	☐	☐	☐	☐	☐
I reuse rainwater, e.g. for irrigating plants or cleaning the floor.	☐	☐	☐	☐	☐	☐
I bring empty single-use bottles to a recycling bin.	☐	☐	☐	☐	☐	☐
I point out unecological behavior to others.	☐	☐	☐	☐	☐	☐
I contribute financially to environmental organizations.	☐	☐	☐	☐	☐	☐
I buy milk in returnable bottles.	☐	☐	☐	☐	☐	☐
I buy bleached and colored toilet paper.	☐	☐	☐	☐	☐	☐
I buy convenience foods.	☐	☐	☐	☐	☐	☐
I buy products in refillable packages.	☐	☐	☐	☐	☐	☐
I boycott companies with an unecological background.	☐	☐	☐	☐	☐	☐

	Never	Rarely	Occa-sionally	Often	Very often	NA
I check for plumbing leaks (e.g. toilet, faucets, showerhead).	☐	☐	☐	☐	☐	☐
I buy seasonal produce.	☐	☐	☐	☐	☐	☐
I use a clothes dryer.	☐	☐	☐	☐	☐	☐
I read about environmental issues.	☐	☐	☐	☐	☐	☐
I talk with friends about problems related to the environment.	☐	☐	☐	☐	☐	☐
I use the water saving button of my dual flush toilet.	☐	☐	☐	☐	☐	☐
I keep the engine running while waiting in front of a railroad crossing or in a traffic jam.	☐	☐	☐	☐	☐	☐
At red traffic lights, I keep the engine running.	☐	☐	☐	☐	☐	☐
I fix leaks immediately (myself or with professional help).	☐	☐	☐	☐	☐	☐
I kill insects with a chemical insecticide.	☐	☐	☐	☐	☐	☐
In winter, I turn down the heat when I leave my apartment for more than 4 hours.	☐	☐	☐	☐	☐	☐
I drive to the location, where I want to go for a walk.	☐	☐	☐	☐	☐	☐

Section 2: ***For the following statements, please indicate how much you agree or disagree.*** *Choose NA (not applicable) if you are unable to give an answer.*

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
If I want something from a person I dislike, I will act very nicely toward that person in order to get it.	☐	☐	☐	☐	☐
If I knew that I could never get caught, I would be willing to steal a million dollars.	☐	☐	☐	☐	☐
Having a high level of social status is not very important to me.	☐	☐	☐	☐	☐
I deserve more influence and authority than most other people do.	☐	☐	☐	☐	☐
I don't see anything wrong with using flattery to get ahead in life.	☐	☐	☐	☐	☐
I wouldn't cheat a person even if he or she was a real "sucker".	☐	☐	☐	☐	☐
Having a lot of money is not especially important to me.	☐	☐	☐	☐	☐
I am an ordinary person who is no better than others.	☐	☐	☐	☐	☐
I sometimes try to make people feel guilty so that they will do what I want.	☐	☐	☐	☐	☐
I wouldn't feel bad about deceiving people who allow themselves to be deceived.	☐	☐	☐	☐	☐
I prefer to have high-status, successful people as my friends.	☐	☐	☐	☐	☐
I wouldn't want people to treat me as though I were superior to them.	☐	☐	☐	☐	☐
I wouldn't use flattery to get a raise or promotion at work, even if I thought it would succeed.	☐	☐	☐	☐	☐
I would be tempted to buy stolen property if I were financially tight.	☐	☐	☐	☐	☐
I would like to live in a very expensive, high-class neighborhood.	☐	☐	☐	☐	☐

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I am special and superior in many ways.	☐	☐	☐	☐	☐
If I want something from someone, I will laugh at that person's worst jokes.	☐	☐	☐	☐	☐
I would still pay my taxes even if I would not get caught for avoiding them.	☐	☐	☐	☐	☐
I would like to be seen driving around in a very expensive car.	☐	☐	☐	☐	☐
Sometimes I feel that laws should not apply to someone like me.	☐	☐	☐	☐	☐
I wouldn't pretend to like someone just to get that person to do favors for me.	☐	☐	☐	☐	☐
I would never accept a bribe, even if it were very large.	☐	☐	☐	☐	☐
I would enjoy being a member of a fancy, high-class casino.	☐	☐	☐	☐	☐
I think that I am entitled to more respect than the average person is.	☐	☐	☐	☐	☐
If I want something from someone, I ask for it directly, instead of manipulating them into giving it.	☐	☐	☐	☐	☐
I would like to know how to smuggle things across the border.	☐	☐	☐	☐	☐
I would get a lot of pleasure from owning expensive luxury goods.	☐	☐	☐	☐	☐
Some people would say that I have an over-inflated ego.	☐	☐	☐	☐	☐
I often get people to do favors for me by making them feel that they owe me.	☐	☐	☐	☐	☐
I'd be tempted to use counterfeit money, if I were sure I could get away with it.	☐	☐	☐	☐	☐
If there is some chance of improving my social status, I take big risks.	☐	☐	☐	☐	☐
I want people to know that I am an important person of high status.	☐	☐	☐	☐	☐

Section 3: ***For the following behaviors, please indicate whether you perform them or not.*** *Choose the answer that fits your usual behavior best. Choose NA (not applicable) if you are unable to give an answer.*

	Yes	No	NA
I reuse my shopping bags.	☐	☐	☐
In the winter, I keep the heat on so that I do not have to wear thick clothing.	☐	☐	☐
At home we have water-efficient showerheads installed.	☐	☐	☐
I use fabric softener with my laundry.	☐	☐	☐
I put dead batteries in the garbage.	☐	☐	☐
After meals, I dispose of leftovers in the toilet.	☐	☐	☐
I have bought or informed myself about faucet aerators (device added to tap which spreads water stream into many little droplets).	☐	☐	☐
I use a chemical air freshener in my bathroom.	☐	☐	☐
I have bought or informed myself about flow regulators.	☐	☐	☐
I am a member of an environmental organization.	☐	☐	☐
In hotels, I have the towels changed daily.	☐	☐	☐

	Yes	No	NA
I own energy efficient household devices.	☐	☐	☐
After a picnic, I leave the place as clean as it was originally.	☐	☐	☐
I have looked into the pros and cons having a private source of solar power.	☐	☐	☐
I have bought or informed myself about a certified water-efficient washing machine.	☐	☐	☐
I refrain from owning a car.	☐	☐	☐
I have bought or informed myself about a certified water-efficient dishwasher.	☐	☐	☐
I am a member of a carpool.	☐	☐	☐
I have bought water-efficient plants for my room or garden.	☐	☐	☐
I drive in such a way as to keep my fuel consumption as low as possible.	☐	☐	☐
I own a fuel-efficient automobile (less than 3.5 liter per 100 km).	☐	☐	☐

Section 3: ***For the following statements, please indicate how important you find them.***

	Unimportant	Important
Filling the dishwasher completely before usage.	☐	☐
Investing into water saving devices.	☐	☐
Filling the washing machine completely before usage.	☐	☐
Showering for more than 3 minutes.	☐	☐
Rinsing the dishes under running water.	☐	☐
Informing oneself about water conservation techniques is.	☐	☐
Rinsing vegetables under running water.	☐	☐
Turning off the water while brushing one's teeth or soaping up in the shower is.	☐	☐
Reusing wastewater, e.g. for irrigating plants or cleaning the floor.	☐	☐
Searching for water saving opportunities at home.	☐	☐
Reusing rainwater, e.g. for irrigating plants or cleaning the floor.	☐	☐
Cleaning the stairwell/balcony/floor/yard without water (e.g. broom, vacuum cleaner).	☐	☐
Checking for plumbing leaks (e.g. toilet, faucets, showerhead).	☐	☐
Using the water saving button of a dual flush toilet.	☐	☐
Fixing leaks immediately (oneself or with professional help).	☐	☐
Fulfilling every single personal water consumption need.	☐	☐
Taking a shower instead of taking a bath.	☐	☐

Section 4: ***Please fill in some personal information.***

Gender	☐ Male	☐ Female				
Nationality	☐ Jordanian	☐ German	☐ Other			
Religion	☐ Muslim	☐ Protestant	☐ Catholic	☐ Jew	☐ Not religious	☐ Other
Residence						
City	☐ Amman	☐ Berlin	☐ Other			
ZIP Code	☐☐☐☐☐					
Type	☐ Apartment building (2 or more parties)			☐ Single house		☐ Other
Number of people in the household	☐ 1	☐ 2-4	☐ 3-5	☐ 6-10	☐ >10	
Number of cars in the household	☐ 0	☐ 1	☐ 2	☐ 3	☐ >3	
Average household income per month	☐ **JD**	☐ **EURO**				
	☐ < 300	☐ 301 - 600	☐ 601 – 1.200	☐ 1.201 – 2.000	☐ 2.001 – 3.000	☐ > 3.000
Housing area (in sqm)						
Indoor (incl. balcony or terrace)	☐ < 50	☐ 51-100	☐ 101-150	☐ 151-200	☐ 201-400	☐ > 400
Garden	☐ 0	☐ 1-10	☐ 11-20	☐ >20		
Flat roof	☐ 0	☐ 1-10	☐ 11-20	☐ >20		

2 Original questionnaire (English) used for data collection in Jordan

Survey on environmental behavior in Jordan

Mr. Kim Zietlow, M.Sc. – Humboldt University of Berlin, Germany
Dr. Maisa'a W. Shammout, PhD – The University of Jordan, Jordan

THANK YOU for your time and commitment! Your participation is highly appreciated!

Step 1: Please read carefully the key information about this study

- This study is part of a **PhD project by Mr. Kim Zietlow**. The purpose is **scientific only**.
- Your data will be treated **highly confidentially**, i.e. no third persons are granted access.
- You probably need less **25 minutes** to fill out the questionnaire. Please answer **spontaneously without much deliberation**.
- Please proceed **step by step** through the different sections.

Step 2: Please read how to fill out the questionnaire

- There is **no right or wrong** answer.
- Please **answer honestly** about your true behavior in your **current day-to-day life**.
- Please choose **only one answer** for each question.
- Please answer **all questions**. If you are not able to answer a specific question (for example, if you don't have access to a car, you cannot answer the following statement: "I drive my car in or into the city."), mark the field **"NA" (not applicable).**

Correct	Not correct
☒ ☑	☒ ☑ ⊙ ▨

If you have any questions, please contact **Mr. Kim Zietlow** (*Email: kim.zietlow@hu-berlin.de*).

1

Section 1: ***For the following behaviors, please indicate how often you perform them.*** *Choose NA (not applicable) if you are unable to give an answer.*

	Never	Rarely	Occa-sionally	Often	Very often	NA
I ride a bicycle or take public transportation to work or school.	☐	☐	☐	☐	☐	☐
I fill the dishwasher completely before usage.	☐	☐	☐	☐	☐	☐
I buy meat, vegetables, and fruits with eco-labels.	☐	☐	☐	☐	☐	☐
I buy beverages in cans.	☐	☐	☐	☐	☐	☐
I fill the washing machine completely before usage.	☐	☐	☐	☐	☐	☐
I shower for more than 3 minutes.	☐	☐	☐	☐	☐	☐
I use an oven cleaning spray to clean the oven.	☐	☐	☐	☐	☐	☐
I only switch on the bathroom water boiler right before taking a shower.	☐	☐	☐	☐	☐	☐
I rinse the dishes under running water.	☐	☐	☐	☐	☐	☐
I drive my car in or into the city.	☐	☐	☐	☐	☐	☐
In the winter, I leave the windows open for long periods of time to let in fresh air.	☐	☐	☐	☐	☐	☐
I rinse vegetables under running water.	☐	☐	☐	☐	☐	☐
I wash dirty clothes without prewashing.	☐	☐	☐	☐	☐	☐
I drive on freeways at speeds under 100km/h.	☐	☐	☐	☐	☐	☐
I turn off the water while brushing teeth or soaping up in the shower.	☐	☐	☐	☐	☐	☐
I prefer to shower rather than to take a bath.	☐	☐	☐	☐	☐	☐
I reuse greywater, e.g. for irrigating plants or cleaning the floor.	☐	☐	☐	☐	☐	☐
If I am offered a plastic bag in a store, I take it.	☐	☐	☐	☐	☐	☐
I collect and recycle used paper.	☐	☐	☐	☐	☐	☐
I reuse rainwater, e.g. for irrigating plants or cleaning the floor.	☐	☐	☐	☐	☐	☐
I bring empty single-use bottles to a recycling bin.	☐	☐	☐	☐	☐	☐
I point out unecological behavior to others.	☐	☐	☐	☐	☐	☐
I contribute financially to environmental organizations.	☐	☐	☐	☐	☐	☐
I buy drinks in returnable bottles.	☐	☐	☐	☐	☐	☐
I buy bleached and colored toilet paper.	☐	☐	☐	☐	☐	☐

	Never	Rarely	Occa-sionally	Often	Very often	NA
I buy convenience food.	☐	☐	☐	☐	☐	☐
I buy products in refillable packages.	☐	☐	☐	☐	☐	☐
I boycott companies with an unecological background.	☐	☐	☐	☐	☐	☐
I check for leakages at home (e.g. toilet, faucets, showerhead).	☐	☐	☐	☐	☐	☐
I buy seasonal fruits and vegetables.	☐	☐	☐	☐	☐	☐
I use a clothes dryer.	☐	☐	☐	☐	☐	☐
I read about environmental issues.	☐	☐	☐	☐	☐	☐
I talk with friends about problems related to the environment.	☐	☐	☐	☐	☐	☐
I use the water saving button of my dual flush toilet.	☐	☐	☐	☐	☐	☐
I keep the engine running while waiting in a traffic jam.	☐	☐	☐	☐	☐	☐
At red traffic lights, I keep the engine running.	☐	☐	☐	☐	☐	☐
I fix leaks immediately (myself or with professional help).	☐	☐	☐	☐	☐	☐
I kill insects with a chemical insecticide.	☐	☐	☐	☐	☐	☐
In winter, I turn down the heat when I leave my apartment for more than 4 hours.	☐	☐	☐	☐	☐	☐

Section 2: ***For the following statements, please indicate how much you agree or disagree.***

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
If I knew that I could never get caught, I would be willing to steal a million dollars.	☐	☐	☐	☐	☐
Having a lot of money is not especially important to me.	☐	☐	☐	☐	☐
I wouldn't use flattery to get a raise or promotion at work, even if I thought it would succeed.	☐	☐	☐	☐	☐
If I want something from someone, I will laugh at that person's worst jokes.	☐	☐	☐	☐	☐
I wouldn't pretend to like someone just to get that person to do favors for me.	☐	☐	☐	☐	☐
I would never accept a bribe, even if it was very large.	☐	☐	☐	☐	☐
I think that I am entitled to more respect than the average person is.	☐	☐	☐	☐	☐
I would get a lot of pleasure from owning expensive luxury goods.	☐	☐	☐	☐	☐
I'd be tempted to use counterfeit money, if I were sure I could get away with it.	☐	☐	☐	☐	☐
I want people to know that I am an important person of high status.	☐	☐	☐	☐	☐

Section 3: ***For the following behaviors, please indicate whether you perform them or not.*** *Choose the answer that fits your usual behavior best. Choose NA (not applicable) if you are unable to give an answer.*

	Yes	No	NA
I reuse my shopping bags.	☐	☐	☐
In the winter, I keep the heater on so that I do not have to wear thick clothing.	☐	☐	☐
At home we have water-efficient showerheads installed.	☐	☐	☐
I use fabric softener with my laundry.	☐	☐	☐
I put dead batteries in the garbage.	☐	☐	☐
After meals, I dispose of leftovers in the toilet.	☐	☐	☐
I have bought or informed myself about faucet aerators (device added to tap which spreads water stream into many little droplets).	☐	☐	☐
I use a chemical air freshener in my bathroom.	☐	☐	☐
I have bought or informed myself about flow regulators.	☐	☐	☐
I am a member of an environmental organization.	☐	☐	☐
In hotels, I have the towels changed daily.	☐	☐	☐
I own energy efficient household devices.	☐	☐	☐
After a picnic, I leave the place as clean as it was originally.	☐	☐	☐
I have bought or informed myself about a certified water-efficient washing machine.	☐	☐	☐
I refrain from owning a car.	☐	☐	☐
I have bought or informed myself about a certified water-efficient dishwasher.	☐	☐	☐
I am a member of a carpool.	☐	☐	☐
I have bought water-efficient plants for my room or garden.	☐	☐	☐
I conduct periodical maintenance to the water network installation in my house.	☐	☐	☐
I conduct periodical maintenance to the ground and upper tanks.	☐	☐	☐
I water the garden early morning or after the sunset.	☐	☐	☐
I drive in such a way as to keep my fuel consumption as low as possible.	☐	☐	☐
I have a solar water heater on my roof.	☐	☐	☐

Section 4: ***Please fill in some personal information.***

Gender	☐ Male	☐ Female					
Family origin	☐ Jordan	☐ Bedouin	☐ Palestine	☐ Syria	☐ Iraq		
	☐ Lebanon	☐ UAE	☐ Europe	☐ USA	☐ Other		
Year of birth (e.g. 1991)	☐☐☐☐						
Faith/Religion	☐ Muslim	☐ Christian	☐ Other				
Current City of Residence (where you live right now)	☐ Amman	☐ Al-Zarqa	☐ Madaba	☐ Balqa	☐ Jerash	☐ Other	
District (if living in Amman, choose nearest district)	☐ Abdali	☐ Abdoun	☐ Dahiat Al-Rasheed	☐ Jabal Amman	☐ Jabal Al-Hussain	☐ Jabal Al-Weibdeh	☐ Jubeiha
	☐ Khalda	☐ Shmeisani	☐ Sweifieh	☐ Sweileh	☐ University Campus	☐ East Amman	☐ Other

	Q1, 2012	Q2, 2012	Q3, 2012	Q4, 2012
Household water consumption (in cubic meters)	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
Household water bill (in JD)	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐

Average household income per month (in JD, after tax)	☐ <600	☐ 601 – 900	☐ 901 – 1200	☐ 1201 – 1500	☐ 1501 – 1800	☐ 1801 – 2100	☐ 2101 – 2400	☐ 2401 – 2700	☐ >2700

House Type	☐ Apartment building (2 or more parties)	☐ Single house	☐ Other

Number of people in the household	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ >8
Number of adults (18+) in the household	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ >8
Number of rooms	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ >8
Number of bathrooms	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4				
Size of residence (in square meters)	☐ < 50	☐ 51-75	☐ 76-100	☐ 101-125	☐ 126-150	☐ 151-200	☐ >200		
Own garden size (in square meters)	☐ 0	☐ 1-10	☐ 11-20	☐ 21-30	☐ 31-40	☐ 41-50	☐ >50		
Own flat roof size (in square meters)	☐ 0	☐ 1-5	☐ 6-10	☐ 11-15	☐ 16-20	☐ 21-25	☐ >25		

House/apartment has water-efficient washing machine?	☐ yes	☐ no
House/apartment has efficient/dual-flush toilet?	☐ yes	☐ no
House/apartment has low-flow shower heads?	☐ yes	☐ no
House/apartment has water-efficient plants (indoor and outdoor)?	☐ yes	☐ no
House/apartment has water tank for rainwater harvesting?	☐ yes	☐ no

3 Original questionnaire (Arabic) used for data collection in Jordan

استبيان حول السلوك البيئي في الأردن

Mr. Kim Zietlow, M.Sc. – Humboldt University of Berlin, Germany
Supervisor: Dr. Maisa'a W. Shammout, PhD – The University of Jordan, Jordan
Co- Supervisor: **Dr. Alsharifa Hind Jasem,** PhD – The University of Jordan, Jordan

شكرا على وقتك ونقدر مشاركتكم!

الخطوة 1: الرجاء قراءة المعلومات الأساسية عن هذه الدراسة

- هذه الدراسة هي جزء من مشروع رسالة الدكتوراه من السيد Kim Zietlow. وستستخدم هذه الدراسة لأغراض علمية فقط.
- سيتم التعامل بسرية البيانات الخاصة بك للغاية.
- ربما تحتاج أقل من 25 دقيقة لملء الاستبيان. الرجاء الإجابة بشكل عفوي.
- الرجاء الاجابة خطوة بخطوة من خلال الأقسام المختلفة

الخطوة 2: يرجى قراءة كيفية ملء الاستبيان

- الرجاء الإجابة بصراحة عن سلوكك الحقيقي لحياتك اليوميه.
- الرجاء اختيار إجابة واحدة فقط لكل سؤال
- الرجاء الإجابة على جميع الأسئلة. إذا لم تكن قادرا على الإجابة على سؤال محدد (على سبيل المثال، إذا لم يكن لديك سيارة، ولم تتمكن من الإجابة على العبارة التالية: "أنا أقود سيارتي في المدينة ")، ضع علامة "(لا ينطبق)"

اجابة غير صحيحة	لاجابة صحيحة
☒ ☑ ⊙ ▨	☐ ☒ ☑

Mr. Kim Zietlow (*Email: kim.zietlow@hu-berlin.de)*

الفرع 1: للسلوكيات التالية، يرجى الإشارة إلى كيفية ما يمكنك القيام به. اختر (لا تنطبق) إذا كنت غير قادر على إعطاء إجابة.

	لا تنطبق	كثيراً جداً	كثيراً	أحيانا	نادراً ما	ابداً
أذهب الى العمل أو المدرسة بواسطة وسائل النقل العام أو بواسطة الدراجه الهوائية	☐	☐	☐	☐	☐	☐
أملأ غسالة الصحون تماما قبل الاستخدام	☐	☐	☐	☐	☐	☐
أشتري اللحوم والخضروات والفواكه ذات الانتاج البيئية (العضوية)	☐	☐	☐	☐	☐	☐
اشترى المشروبات المعلبه	☐	☐	☐	☐	☐	☐
أملأ الغسالة تماما قبل الاستخدام	☐	☐	☐	☐	☐	☐
أخذ دش لمدة تزيد عن 3 دقائق	☐	☐	☐	☐	☐	☐
أستخدم رذاذ التنظيف لتنظيف الفرن	☐	☐	☐	☐	☐	☐
أشغل سخان المياه مباشرة قبل الاستحمام	☐	☐	☐	☐	☐	☐
أشطف الأطباق تحت الماء الجاري	☐	☐	☐	☐	☐	☐
أقود سيارتي داخل وحول المدينة	☐	☐	☐	☐	☐	☐
في فصل الشتاء، اترك النوافذ مفتوحة لفترات طويلة من الوقت لدخول الهواء النقي	☐	☐	☐	☐	☐	☐
أشطف الخضروات تحت الماء الجاري	☐	☐	☐	☐	☐	☐
أغسل الملابس المتسخة دون غسيل مسبق	☐	☐	☐	☐	☐	☐
أقود على الطرق السريعة بسرعة أقل من 100 كم/ ساعة	☐	☐	☐	☐	☐	☐
أغلق المياه أثناء تنظيف الأسنان أو أثناء استخدام الصابون	☐	☐	☐	☐	☐	☐
أنا أفضل أخذ دش بدلاً من الاستحمام	☐	☐	☐	☐	☐	☐
يمكنني إعادة استخدام المياه الرمادية، على سبيل المثال لري النباتات أو لتنظيف الأرض	☐	☐	☐	☐	☐	☐
اذا عرض علي أكياس بلاستيك في المتجر، آخذها	☐	☐	☐	☐	☐	☐
أجمع، وإعيد تدوير الورق المستعمل	☐	☐	☐	☐	☐	☐
يمكنني إعادة استخدام مياه الأمطار، على سبيل المثال لري النباتات أو لتنظيف الأرض	☐	☐	☐	☐	☐	☐
أنقل الزجاجات الفارغة المستخدمه لإعادة تدوير	☐	☐	☐	☐	☐	☐
أنبه الآخرين للسلوك الغير البيئي	☐	☐	☐	☐	☐	☐
أتبرع ماليا للمنظمات البيئية	☐	☐	☐	☐	☐	☐
اشترى المشروبات في الزجاجات الواجب إعادتها	☐	☐	☐	☐	☐	☐
اشترى ورق التواليت المصبوغ المبيض أو الملون	☐	☐	☐	☐	☐	☐

	ابداً	نادراً ما	أحيانا	كثيراً	كثيراً جداً	لا تنطبق
اشترى الغذاء ذو التحضير المريح (مثل الغذاء المعلب)	☐	☐	☐	☐	☐	☐
أشترى المنتجات في عبوات قابلة لإعادة التعبئة	☐	☐	☐	☐	☐	☐
أقاطع الشركات الغير بيئيه	☐	☐	☐	☐	☐	☐
أتحقق من التسربات في المنزل (مثل المرحاض، الحنفيات، الدش)	☐	☐	☐	☐	☐	☐
أشترى الفواكه والخضراوات الموسمية	☐	☐	☐	☐	☐	☐
استخدم مجفف الملابس	☐	☐	☐	☐	☐	☐
أقرأ عن القضايا البيئية	☐	☐	☐	☐	☐	☐
أتحدث مع الأصدقاء حول المشاكل المتعلقة بالبيئة	☐	☐	☐	☐	☐	☐
استخدم زر الدافق المزدوج في المرحاض لتوفير المياه	☐	☐	☐	☐	☐	☐
أبقي تشغيل المحرك أثناء الانتظار في ازدحام حركة المرور	☐	☐	☐	☐	☐	☐
أبقي تشغيل المحرك أثناء إشارات المرور الحمراء	☐	☐	☐	☐	☐	☐
اصلح التسرب فورا (بنفسي أو مع المساعدة المهنيه)	☐	☐	☐	☐	☐	☐
أقتل الحشرات بمبيد حشري كيميائي	☐	☐	☐	☐	☐	☐
في فصل الشتاء، اغلق التدفئه عندما أغادر شقتي لأكثر من 4 ساعات	☐	☐	☐	☐	☐	☐

الفرع 2: للعبارات التالية، يرجى بيان كم كنت تتفق أو تختلف

	لا أوافق بشدة	لا أوافق	محايد	موافق	اتفق بشدة
وسأكون على استعداد لسرقة مليون دولار، إذا كنت متأكدا أنه لا يمكن الامساك بي.	☐	☐	☐	☐	☐
وجود الكثير من المال ليس مهما بالنسبة لي	☐	☐	☐	☐	☐
لا أستخدم التملق للحصول على ترقية في العمل، حتى لو اعتقدت أنه سينجح	☐	☐	☐	☐	☐
إذا كنت أريد شيئا من شخص ما، أضحك حتى على نكته السيئه	☐	☐	☐	☐	☐
أنا لا اتملق لشخص من أجل الحصول على فائده منه	☐	☐	☐	☐	☐
أنا لا أقبل الرشوة، حتى لو كانت كبيره جدا	☐	☐	☐	☐	☐
أعتقد أنني أستحق الاحترام أكثر من أي شخص عادي	☐	☐	☐	☐	☐
أحصل على الكثير من المتعة عند امتلاك السلع الفاخرة والباهظة الثمن	☐	☐	☐	☐	☐
سأستخدام النقود المزيفة، إذا كنت متأكد من عدم القبض علي	☐	☐	☐	☐	☐
أحب أن تعرف الناس أنه أنا شخص مهم ومن المنزلة الرفيعة	☐	☐	☐	☐	☐

الجزء الثالث: في حالة السلوكات البيئية التالية : الرجاء ذكر اذا كنت تقوم بها ام لا (اختار الاجابة التي تتوافق افضل موافقة مع سلوكك المعتاد،اختار نعم للمتوافق_ لا لغير المتوافق و لا تنطبق في حالة عدم القدرة على الاجابة

	نعم	لا	لا تنطبق
اقوم بأعادة استخدام اكياس التسوق	☐	☐	☐
في الشتاء، اقوم بتشغيل التدفئة اطول وقت ممكن لكي اخفف من مقدار الملابس التي ارتديها	☐	☐	☐
في المنزل لدينا ادوات توفير المياه في الدش	☐	☐	☐
اقوم باستعمال منعم الاقمشة في الغسيل	☐	☐	☐
اقوم بالقاء البطاريات المنتهية في سلة المهملات	☐	☐	☐
بعد انهاء الوجبة، هل تقوم بالقاء الطعام المتبقي في التواليت؟؟	☐	☐	☐
قمت بشراء او تثقيف نفسي عن ادوات توفير المياه في المنزل "منظمات التدفق للمياه"	☐	☐	☐
استعمل ملطفات جو كيميائية في حمام المنزل	☐	☐	☐
قمت بشراء او تثقيف نفسي عن ادوات تقليل ضغط المياه في الانابيب لتوفير المياه	☐	☐	☐
انا عضو في جمعية بيئية	☐	☐	☐
في الفندق، اطلب غسل المناشف وتغييرها يوميا	☐	☐	☐
امتلك الاجهزة المنزليه الموفرة للطاقة	☐	☐	☐
بعد قضاء الرحلة هل تقوم بتنظيف المكان كما وجدته تماما	☐	☐	☐
قمت بشراء أو تثقيف نفسي عن غسالة الملابس الموفرة للمياه	☐	☐	☐
امتنع عن امتلاك سيارة	☐	☐	☐
قمت بشراء أو تثقيف نفسي عن غسالة الأطباق الموفرة للمياه	☐	☐	☐
أقوم بمشاركة السيارة مع زملائي في الجامعه	☐	☐	☐
قمت بشراء نباتات موفرة للمياه للحديقة والغرفة	☐	☐	☐
أقوم بعمل صيانه دورية لشبكة المياه في المنزل	☐	☐	☐
أقوم بعمل مراقبة دوريه وصيانه للخزانات الارضية والخزانات فوق المنزل	☐	☐	☐
اعمل علي ري الحديقة قبل الشروق والغروب	☐	☐	☐
اقود بطريقة توفر استهلاك الوقود قدر الإمكان	☐	☐	☐
امتلك احد انظمة سخانات المياه الشمسية فوق سطح المنزل	☐	☐	☐

الجزء الرابع: الرجاء تعبئة بعض المعلومات الشخصية:

الجنس	☐ ذكر	☐ أنثى				
الجنسية	☐ الأردن	☐ فلسطين	☐ سوريا	☐ العراق	☐ لبنان	
	☐ الامارات	☐ أوروبا	☐ أمريكي	☐ غير ذلك		
سنة الميلاد (مثال: 1991)	☐☐☐☐					
مكان الأقامة الحالي	☐ عمان	☐ الزرقاء	☐ مادبا	☐ البلقاء	☐ جرش	☐ غير ذلك
المنطقة (في حالة السكن في عمان الرجاء تحديد المنطقة الاقرب)	☐ العبدلي	☐ عبدون	☐ ضاحية الرشيد	☐ جبل عمان	☐ جبل الحسين	☐ جبل اللويبدة	☐ الجبيهة
	☐ خلدا	☐ الشميساني	☐ الصويفية	☐ صويلح	☐ حي الجامعة	☐ شرق عمان	☐ غير ذلك

	1. Quarter, 2012	2. Quarter, 2012	3. Quarter, 2012	4. Quarter, 2012
كمية استهلاك المياه (الفاتورة) (بالمترات المربعة)	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
مقدرا فاتورة المياه (بالدينار الاردني)	☐☐☐,☐☐	☐☐☐,☐☐	☐☐☐,☐☐	☐☐☐,☐☐

معدل تقريبي للدخل الشهري للأسرة (بالدينار الاردني_ بعد الضريبة)	☐ <600	☐ 601 – 900	☐ 901 – 1200	☐ 1201 – 1500	☐ 1501 – 1800	☐ 1801 – 2100	☐ 2101 – 2400	☐ 2401 – 2700	☐ >2700

نوع المنزل	☐ شقة من عمارة_ غرفتين أو اكثر	☐ منزل مستقل	☐ غير ذلك

عدد الأفراد في المنزل	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ >8
عدد البالغين في الأسرة (+18)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ >8
عدد الغرف في المنزل	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ >8
عدد الحمامات في المنزل	☐ 1	☐ 2	☐ 3	☐ 4	☐ >4				
مساحة المنزل (السكن) (بالمترات المربعة)	☐ < 50	☐ 51-75	☐ 76-100	☐ 101-125	☐ 126-150	☐ 151-200	☐ >200		
مساحة الحديقة المنزلية (بالمترات المربعة)	☐ 0	☐ 1-10	☐ 11-20	☐ 21-30	☐ 31-40	☐ 41-50	☐ >50		
مساحة سقف المنزل (بالمترات المربعة)	☐ 0	☐ 1-5	☐ 6-10	☐ 11-15	☐ 16-20	☐ 21-25	☐ >25		

هل يوجد غسالة ذات كفاءة توفير المياه في المنزل	☐ نعم	☐ لا
هل يوجد تقنية لتوفير مياه السيفون المستخدم في التواليت	☐ نعم	☐ لا
هل يوجد تقنية التدفق القليل نسبيا لمياه الدش	☐ نعم	☐ لا
هل توجد في المنزل أو الحديقة نباتات ذات استهلاك مائي قليل	☐ نعم	☐ لا
هل يوجد في المنزل خزانات لجمع مياه الأمطار	☐ نعم	☐ لا

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Eidesstattliche Erklärung

Ich versichere, dass ich die von mir vorgelegte Dissertation selbstständig und ohne unerlaubte Hilfe angefertigt und andere als die angegebenen Hilfsmittel nicht benutzt habe.

Kim J. Zietlow

Berlin, 26.08.2015